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**United States Court of Appeals
for the Federal Circuit**

DIGITECH IMAGE TECHNOLOGIES LLC,

Plaintiff-Appellant,

v.

ELECTRONICS FOR IMAGING, INC.,
SAKAR INTERNATIONAL, INC. (doing business as Vivitar),
GENERAL IMAGING COMPANY, OVERSTOCK.COM, INC.,
NEWEGG, INC., NEWEGG.COM, INC., XEROX CORPORATION,
TOSHIBA CORPORATION, TOSHIBA AMERICA BUSINESS SOLUTIONS, INC., TOSHIBA AMERICA INFORMATION SYSTEMS, INC., and TOSHIBA AMERICA, INC.,

Defendants-Appellees,

and

BUY.COM, INC.,

Defendant-Appellee,

and

B AND H FOTO AND ELECTRONICS CORP.,

Defendant-Appellee,

and

LEAF IMAGING, LTD. (doing business as Mamiyaleaf)
and MAMIYA AMERICA CORP.,

Defendants-Appellees,

and

LEICA CAMERA AG and LEICA CAMERA, INC.,

Defendants-Appellees,

and

FUJIFILM CORPORATION, SIGMA CORPORATION,
SIGMA CORPORATION OF AMERICA, MICRO ELECTRONICS, INC.
(doing business as Micro Center), PENTAX RICOH IMAGING CO., LTD.,
PENTAX RICOH IMAGING AMERICAS CORPORATION,
RICOH COMPANY, LTD., RICOH AMERICAS CORPORATION,
and KONICA MINOLTA BUSINESS SOLUTIONS USA, INC.,

Defendants-Appellees,

and

ASUS COMPUTER INTERNATIONAL,
and ASUSTEK COMPUTER, INC.,

Defendants-Appellees,

and

CDW LLC,

Defendant-Appellee,

and

VICTOR HASSELBLAD AB and
HASSELBLAD USA, INC.,

Defendants-Appellees,

and

MAMIYA DIGITAL IMAGING CO., LTD.

Defendant,

Appeals from the United States District Court for the Central District of California in consolidated case no. 12-CV-1324, Judge Otis D. Wright, II.

"CORRECTED" NON-CONFIDENTIAL JOINT APPENDIX

Dated: January 24, 2014

John J. Edmonds
Stephen F. Schlather
Shea Palavan
COLLINS, EDMONDS, POGORZELSKI, SCHLATHER & TOWER, PLLC
1616 South Voss Road, Suite 125
Houston, Texas 77057
Telephone: (281) 501-3425
Facsimile: (832) 415-2535
jedmonds@cepiplaw.com
sschlather@cepiplaw.com
spalavan@cepiplaw.com

Attorneys for Plaintiff-Appellant
DIGITECH IMAGE TECHNOLOGIES LLC

Steven J. Routh
Sten Jensen
John R. Inge
ORRICK, HERRINGTON & SUTCLIFFE LLP
1152 15th Street, NW
Washington, D.C. 20005-1706
Telephone: 202-339-8400
Fax: 202-339-8500
srouth@orrick.com
sjensen@orrick.com
jinge@orrick.com

Christopher P. Broderick
William H. Wright
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, CA 90017-5855
Telephone: 213-629-2020
Fax: 213-612-2499
cbroderick@orrick.com
wwright@orrick.com

Attorneys for Defendants-Appellees FUJIFILM Corporation, Sigma Corporation, Sigma Corporation of America, Micro Electronics, Inc., Pentax Ricoh Imaging Co., Ltd., Pentax Ricoh Imaging Americas Corporation, Ricoh

Company, Ltd., Ricoh Americas Corporation, and Konica Minolta Business Solutions USA, Inc.

Mark A. Lemley
DURIE TANGRI LLP
217 Leidesdorff Street
San Francisco, CA 94111
Telephone: 415-362-6666
Fax: 415-236-6300
mlemley@law.stanford.edu

Attorney for Defendants-Appellees Electronics For Imaging, Inc.; Sakar International, Inc. (doing business as Vivitar); General Imaging Company; Overstock.com, Inc.; Newegg, Inc. and Newegg.com, Inc.; Xerox Corporation; Toshiba Corporation; Toshiba America Business Solutions, Inc.; Toshiba America Information Systems, Inc., and Toshiba America, Inc.

Ezra Sutton & Associates, P.A.
900 Route 9 North
Plaza 9, Suite 201
Woodbridge, New Jersey 07095
Telephone: 732-634-3520
Fax: 732-634-3511
esutton@ezrasutton.com

Attorney for Sakar International, Inc.

Frank P. Coté
William C. Rooklidge
Frank P. Coté
Mark L. Blake
JONES DAY
3161 Michelson Drive, Suite 800
Irvine, CA 92612-4408

Telephone: 949-851-3939
Fax: 949-553-7539
wrooklidge@jonesday.com
fcote@jonesday.com
mblake@jonesday.com

Attorneys for Defendant-Appellee Electronics for Imaging, Inc.

Paul T. Meiklejohn
Mudit Kakar
DORSEY & WHITNEY LLP
701 Fifth Avenue, Suite 6100
Seattle, WA 98104
Telephone: 206-903-8800
Fax: 206-903-8820
meiklejohn.paul@dorsey.com
kakar.mudit@dorsey.com

Attorneys for Defendants-Appellees Toshiba Corporation; Toshiba America Business Solutions, Inc.; Toshiba America Information Systems, Inc., and Toshiba America, Inc.

Gregory S. Tamkin
Case Collard
DORSEY & WHITNEY LLP
1400 Wewatta St., Suite 400
Denver, CO 80202
Telephone: 303-629-3400
Fax: 303-629-3450
tamkin.greg@dorsey.com
collard.case@dorsey.com

Attorneys for Defendant-Appellee Buy.com, Inc.

Anthony S. Gabrielson
Tiffany D. Gehrke
MARSHALL, GERSTEIN & BORUN LLP
233 South Wacker Drive
6300 Willis Tower
Telephone: 312-474-6300
Fax: 312-474-0448
agabrielson@marshallip.com
tgehrke@marshallip.com

Attorneys for Defendant-Appellee CDW LLC

J. Rick Taché
GREENBERG TRAURIG, LLP
3161 Michelson Drive, Suite 1000
Irvine, CA 92612
Telephone: 949-732-6500
Fax: 949-732-6501
tacher@gtlaw.com

Attorneys for Defendant-Appellee LEAF IMAGING, LTD. (doing business as Mamiyaleaf), and MAMIYA AMERICA CORPORATION, MAMIYA DIGITAL IMAGING CO., LTD.

Michael H. Jacobs
CROWELL & MORING LLP
1001 Pennsylvania Avenue, N.W.
Washington, DC 20009
Telephone: 202-624-2500
Fax: 202-628-5116
mjacobs@crowell.com

Attorneys for Defendant-Appellee LEICA CAMERA AG and LEICA CAMERA INC.

Mark C. Johnson
Kyle B. Fleming
Nicholas J. Gingo
RENNER, OTTO, BOISSELLE & SKLAR, LLP
1621 Euclid Avenue, 19th Floor
Cleveland, Ohio 44115
Telephone: 216-621-1113
Fax: 216-621-6165
mjohnson@rennerotto.com
kfleming@rennerotto.com
ngingo@rennerotto.com
Attorneys for Defendant-Appellee
VICTOR HASSELBLAD AB and
HASSELBLAD USA, INC.

Aaron Stiefel
KAYE SCHOLER LLP
425 Park Avenue
New York, NY 10022
Telephone: 212-836-8442
Fax: 212-836-8689
Aaron.stiefel@kayescholer.com

Attorney for Defendant-Appellee
B&H FOTO & ELECTRONICS CORP.

DIGITECH IMAGE TECHNOLOGIES V. ELECTRONICS FOR IMAGING

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC. et al., Defendants.	Case No. 8:12-cv-1324-ODW(MRWx) **JUDGMENT**

In light of the Court's Order Granting Motion for Summary Judgment (*Digitech Image Techs., LLC v. Elecs. for Imaging, Inc.*, No. 8:12-cv-1324-ODW(MRWx) (C.D. Cal. July 31, 2013) (ECF No. 88)) and the parties' representations in their August 5, 2013 Joint Status Report (*Id.* (ECF No. 90)), **IT IS HEREBY ORDERED:**

1. Plaintiff Digitech Image Technologies, LLC shall take nothing;
2. Judgment for each of the Defendants in this and the related cases as listed below:
   a. Electronics for Imaging, Inc. (8:12-cv-1324-ODW(MRWx));
   b. Buy.Com, Inc. (8:12-cv-1668-ODW(MRWx));
   c. B and H Foto and Electronics Corp. (8:12-cv-1671-ODW(MRWx));
   d. Sakar International, Inc. (8:12-cv-1673-ODW(MRWx));
   e. Mamiya Digital Imaging Co., Ltd.; Leaf Imaging, Ltd.; Mamiya America Corp. (8:12-cv-1675-ODW(MRWx));

f. Leica Camera AG; Leica Camera, Inc. (8:12-cv-1677-ODW(MRWx));

g. Fujifilm Corp. (8:12-cv-1679-ODW(MRWx));

h. General Imaging Co. (8:12-cv-1680-ODW(MRWx));

i. Sigma Corp.; Sigma Corp. of America (8:12-cv-1681-ODW(MRWx));

j. Micro Electronics, Inc. (8:12-cv-1686-ODW(MRWx));

k. Overstock.com, Inc. (8:12-cv-1687-ODW(MRWx));

l. Newegg, Inc.; Newegg.com, Inc. (8:12-cv-1688-ODW(MRWx));

m. Pentax Ricoh Imaging Co., Ltd.; Pentax Ricoh Imaging Americas Corp.; Ricoh Co., Ltd.; Ricoh Americas Corp. (8:12-cv-1689-ODW(MRWx));

n. Xerox Corp. (8:12-cv-1693-ODW(MRWx));

o. Konica Minolta Business Solutions USA, Inc. (8:12-cv-1694-ODW(MRWx));

p. CDW LLC (8:12-cv-1695-ODW(MRWx));

q. Victor Hasselblad AB; Hasselblad USA, Inc. (8:12-cv-1696-ODW(MRWx));

r. Casio Computer Co. Ltd.; Casio America, Inc. (8:12-cv-1697-ODW(MRWx));

s. Asus Computer International; Asustek Computer, Inc. (8:12-cv-2122-ODW(MRWx));

t. Toshiba Corp.; Toshiba America, Inc.; Toshiba America Business Solutions, Inc.; Toshiba America Information Systems, Inc. (8:12-cv-2127-ODW(MRWx));

3. The Clerk of Court shall close this case.

IT IS SO ORDERED.

August 6, 2013

OTIS D. WRIGHT, II
UNITED STATES DISTRICT JUDGE

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC. et al., Defendants.	Case No. 8:12-cv-1324-ODW(MRWx) **ORDER GRANTING MOTION FOR SUMMARY JUDGMENT [64]**

I. INTRODUCTION

Under 35 U.S.C. § 101, patent claims must be directed to one of the four patent-eligible subject-matter categories: processes, machines, manufactures, or compositions of matter. Inventions that fit within one or more of the statutory categories are nonetheless patent ineligible if they are coextensive with laws of nature, natural phenomenon, or abstract ideas, unless the inventions include substantive limitations that would add "significantly more" to the underlying principles. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1294 (2012).

Plaintiff Digitech Image Technologies LLC's '415 Patent claims a device profile and a method of generating a device profile.[1] A device profile describes the

[1] U.S. Patent No. 6,128,415, claims 1–6, 9, 10–15, and 26–31.

color and spatial properties of a device so that a processed image can be more accurately captured, transformed, or rendered, minimizing color and spatial distortions produced by an imaging device. ('415 Patent 1:8–11; 1:32–34.) Although past attempts to correct these image distortions are not new, they have been device dependent. (*Id.* at 1:35–36.) The '415 Patent seeks to improve digital-imaging processing through use of device-independent device profiles by applying a device-independent paradigm for the spatial characterization. (*Id.* at 1:64–2:1; 2:4–9.)

Defendants assert that these claims either fall outside the four subject-matter categories or merely describe an ineligible abstract idea.[2] For the reasons discussed below, the Court finds that the asserted claims are patent ineligible and **GRANTS** Defendants' Motion for Summary Judgment of Invalidity.[3] (ECF No. 64.)

II. LEGAL STANDARD

Summary judgment should be granted if there are no genuine issues of material fact and the moving party is entitled to judgment as a matter of law. Fed. R. Civ. P. 56(c). The moving party bears the initial burden of establishing the absence of a genuine issue of material fact. *Celotex Corp. v. Catrett*, 477 U.S. 317, 323–24 (1986). Once the moving party has met its burden, the nonmoving party must go beyond the pleadings and identify specific facts through admissible evidence that show a genuine issue for trial. *Id.*; Fed. R. Civ. P. 56(c). Conclusory or speculative testimony in affidavits and moving papers is insufficient to raise genuine issues of fact and defeat summary judgment. *Thornhill's Publ'g Co. v. GTE Corp.*, 594 F.2d 730, 738 (9th Cir. 1979).

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[2] Defendants FUJIFILM Corp.; Sigma Corp.; Sigma Corp. of America; Pentax Ricoh Imaging Co., Ltd.; Pentax Ricoh Imaging Americas Corp.; Ricoh Company, Ltd.; Ricoh Americas Corp.; and Konica Minolta Business Solutions, U.S.A., Inc. bring this Motion for Summary Judgment. The Court enters this order in each of the separate cases as well as in the lead case: 8:12-cv-1324-ODW(MRWx); 8:12-cv-1679-ODW(MRWx); 8:12-cv-1681-ODW(MRWx); 8:12-cv-1689-ODW(MRWx); 8:12-cv-1694-ODW(MRWx).

[3] Having considered the papers filed in support of and in opposition to this Motion, the Court deems the matter appropriate for decision without oral argument. Fed. R. Civ. P. 78; L.R. 7–15.

A genuine issue of material fact must be more than a scintilla of evidence, or evidence that is merely colorable or not significantly probative. *Addisu v. Fred Meyer*, 198 F.3d 1130, 1134 (9th Cir. 2000). A disputed fact is "material" where the resolution of that fact might affect the outcome of the suit under the governing law. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248 (1968). An issue is "genuine" if the evidence is sufficient for a reasonable jury to return a verdict for the nonmoving party. *Id.* Where the moving and nonmoving parties' versions of events differ, courts are required to view the facts and draw reasonable inferences in the light most favorable to the nonmoving party. *Scott v. Harris*, 550 U.S. 372, 378 (2007).

III. DISCUSSION

"Anything under the sun" may be considered an invention, but only those satisfying the conditions under § 101 are patentable. *Bilski v. Kappos*, 130 S. Ct. 3218, 3249 (2010). Determinations of patent eligibility are questions of law and require a two-step analysis. *CyberSource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1369 (Fed. Cir. 2011); *Bilski*, 130 S. Ct. at 3225. First, the claimed invention must fall within one of the four eligible subject-matter categories: processes, machines, manufactures, or compositions of matter. *Bilski*, 130 S. Ct. at 3225; 35 U.S.C. § 101. Second, if the claimed invention falls within one of the four categories, it still must not wholly embrace one of the three judicially recognized exceptions: laws of nature, physical phenomena, and abstract ideas. *Bilski*, 130 S. Ct. at 3225.

All inventions, at some level, "embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas." *Mayo*, 132 S. Ct. at 1293. So applying the judicially recognized exceptions too broadly would "eviscerate patent law." *Id.* And though a practical application of an abstract idea to a structure or process may be patented, "one must do more than simply state the [abstract idea] while adding the words 'apply it.'" *Id.* at 1294. Thus, the goal of § 101 is to guard against the "wholesale preemption of fundamental principles," while looking beyond mere claim-drafting strategies such as "highly stylized language, hollow field-of-use limitations,

or the recitation of token post-solution activity." *CLS Bank Int'l v. Alice Corp.*, No. 2011-1301, 2013 U.S. App. LEXIS 9493, at *28, 30 (Fed. Cir. May 10, 2013) (en banc) (Lourie, J., concurring).

The Supreme Court has eschewed the Federal Circuit's formulas for patent eligibility like the machine-or-transformation test and has directed courts to employ a "flexible, claim-by-claim approach to subject-matter eligibility that avoids rigid line drawings." *Id.* at *30–31. And as with all invalidity inquiries, a § 101 eligibility determination presupposes that a patent is entitled to a presumption of validity. *Microsoft Corp. v. i4i Ltd. P'ship*, 131 S. Ct. 2238, 2252 (2011); 35 U.S.C. § 282. Hence, a court must carefully consider "meaningful limitations" that prevent a claim from covering every practical application of a fundamental concept and preserve the claim's validity. *CLS Bank*, 2013 U.S. App. LEXIS 9493, at *29.

Although the parties do not contend that claim construction is necessary nor assert any particular constructions, the Court is obligated to first consider this issue. *State St. Bank & Trust. Co. v. Signature Fin. Grp.*, 149 F.3d 1368, 1370 (Fed. Cir. 1998) (explaining that the issue of § 101 patent eligibility is "a matter of both claim construction and statutory construction"). The only term needing construction in this § 101 analysis is the term "device profile," found in every asserted claim.

A. Claim construction

Claim construction is a question of law to be decided by the court. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc). In construing claim terms, the Court must begin with an examination of the claim language itself. *August Tech. Corp. v. Camtek, Ltd.*, 655 F.3d 1278, 1284 (Fed. Cir. 2011); *see also Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248 (Fed. Cir. 1998) ("The claims define the scope of the right to exclude; the claim construction inquiry, therefore, begins and ends in all cases with the actual words of the claim.").

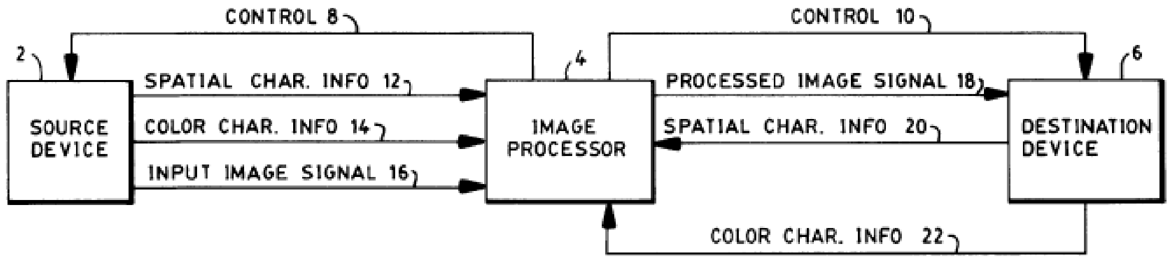
/ / /

The terms used in the claims are generally given their "ordinary and customary meaning." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). This "ordinary and customary meaning" is the meaning as understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips*, 415 F.3d at 1313. A patentee is presumed to have intended the ordinary meaning of a claim term in the absence of an express intent to the contrary. *Id*. In some instances, a term's ordinary meaning may be readily apparent, in which case the court need only apply the widely accepted meaning of commonly understood words. *Acumed LLC v. Stryker Corp.*, 483 F.3d 800, 805 (Fed. Cir. 2007).

The person of ordinary skill in the art is deemed to read the claim term in the context of the entire patent. *Phillips*, 415 F.3d at 1313. Thus, claim terms are interpreted in light of the intrinsic evidence of record, including the specification, written description, drawings, and prosecution history. *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1324–25 (Fed. Cir. 2002).

Courts may also rely on extrinsic evidence, such as expert testimony, dictionaries, and learned treatises, to better understand the underlying technology and to determine what a person of ordinary skill in the art would understand the claim terms to mean. *Phillips*, 415 F.3d at 1317–18. But while extrinsic evidence can be useful, it is less reliable and less significant than the intrinsic record in determining the meaning of claim language. *Id*. at 1318. Particularly, expert testimony should be discounted if it is "clearly at odds with the claim construction mandated by the claims" or are merely conclusory, unsupported assertions. *Id.*

The '415 Patent describes a digital-image processing system comprising a source (image-acquisition) device, an image processor, and an output device. ('415 Patent 2:49–63.) Color-characteristic and spatial-characteristic information relating to the source and output devices is passed to the image processor along with image data, allowing the processor to more accurately capture, transform, or render an image. ('415 Patent 2:49–3:11.) This is represented in the following diagram:



('415 Patent, Fig. 1.)

The specification refers to a tagged file structure as a device profile. ('415 Patent 1:66–67.) This device profile can include a "characterization of a device's image pixel data in device independent color space" as well as "spatial characteristics" of the device. ('415 Patent 1:64–2:3.) It is clear that these characteristics are just numerical data, whether raw or calculated. ('415 Patent 1:55–64 (color characteristics can be represented by "image pixel data (digits) in a device independent color space—e.g. CIE L*a*b* or CIE XYZ"); '415 Patent 3:12–31 (spatial characteristics can be represented by mathematical functions describing "added noise and image signal transform characteristics" or "a gray level dependent additive noise").)

The Court finds no reason to construe the term "device profile" to mean anything other than its plain and ordinary meaning. Synonyms that may be appropriate are tagged file structure,[4] data set, or paradigm—but these do no better job at describing "device profile" than its plain and ordinary meaning. What is certain,

[4] Digitech contends that a device profile can exist as "a 'tag' appended to a digital image obtained using a digital image processing system," and is therefore a tangible object. (Opp'n 8.) There are two problems with this statement. First, the specification points out that the characterization of a device "is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device." Thus, it is the imaging device that has this device profile or tag; the tag is not part of a digital image. ('415 Patent 1:64–2:1.) Second, while a tag may exist as an appendage of a digital image, it is not a tangible object. A case may be made that data describing a digital image should be considered tangible. *See In re Abele*, 684 F.2d 902, 908–09 (C.C.P.A. 1982) (holding that electronic transformation of data into a visual depiction of body tissues satisfied the transformation test for patent eligibility). But data describing a device profile is many shades less tangible—not only does it not *represent* anything tangible, it only represents intangible properties of a device.

and most relevant in this § 101 analysis, is that the meaning of "device profile" does not connote being a physical object, comprising a physical component, or having a physical manifestation. *See In re Ferguson*, 558 F.3d 1359, 1365–66 (Fed. Cir. 2009) ("Paradigm claims do not recite a concrete thing, consisting of parts, or of certain devices and combination of devices." (internal quotation marks omitted)).

Turning to the asserted claims, these can be divided into two categories of claims: ones for a device profile (claims 1–6, 9, and 26–31); and ones for a method of generating a device profile (claims 10–15). The Court first addresses the device-profile claims, and then proceeds to analyze the remaining claims.

B. The device-profile claims (claims 1–6, 9, and 26–31) do not fall within any of the four statutory categories for patent eligibility

Claims 1 and 26 are the two independent claims of the '415 Patent directed to a device profile:

> 1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:
>
> first data for describing a device dependent transformation of color information content of the image to a device independent color space; and
>
> second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.
>
> 26. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

('415 Patent 5:33–41; 7:8–15.) Section 101 demands that the claimed invention be a process, machine, manufacture, or composition of matter. *Bilski*, 130 S. Ct. at 3225. Claims 1 and 26 are none of these.

Claim 1 describes a device profile. This profile comprises a first piece of data relating to color information, and a second piece of data relating to spatial information. Nothing in claim 1 describes anything tangible.

To qualify as a machine under § 101, it must be a "concrete thing." *In re Nuijten*, 500 F.3d 1346, 1355 (Fed. Cir. 2007). Intangible things such as "a transitory signal made of . . . electromagnetic variances . . . [may be] physical and real, [but] it does not possess concrete structure in the sense implied" under § 101. *Id.* A device profile is nothing more than an intangible set of data—it is nothing more than numbers. *See In re Warmerdam*, 33 F.3d 1354, 1362–63 (Fed. Cir. 1994) (holding that a "data structure" relating to a hierarchy of bubbles was patent ineligible because it only referred to the manipulation of ineligible, purely mathematical ideas).

Similarly, a manufacture must be tangible. A manufacture refers to articles resulting from processing materials to give these materials new forms, qualities, properties, or combinations. *Id.* at 1356. Notably, the term "manufacture" as used in the statute is a noun. *Bayer AG v. Housey Pharm., Inc.*, 340 F.3d 1367, 1373 (Fed. Cir. 2003). So, "manufacture" does not refer to the making or modifying of data, signals, or other intangible objects. *See Nuijten*, 500 F.3d at 1356–57. A device profile is just data, something intangible and not considered a manufacture. And the fact that a device profile is made of a color component and a spatial component does not qualify it as a manufacture—a combination of intangible objects does not create a tangible one.

Further, a device profile is not a composition of matter. A composition of matter is defined as "all compositions of two or more substances and . . . all composite articles, whether they be the results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids." *Diamond v. Chakrabarty*, 447 U.S. 303, 308 (1980) (internal quotation marks omitted). Digitech contends that a device profile is a composition of matter but fails to explain how that is so. (Opp'n 19.) The key word in this category is "matter"—meaning that the claimed object must be

tangible. A device profile, however composed of different bits of data, cannot constitute matter.

Finally, a device profile is not a process. A process requires action; it is "an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing." *Gottschalk v. Benson*, 409 U.S. 63, 70 (1972) (internal quotation marks omitted). Digitech does not argue that a device profile is a process, and the Court sees no reason how it could be. Thus, failing to fall within one of the four patent-eligible subject-matter categories, claim 1 is invalid under § 101.

In the same way, the device profile in claim 26 fails to fall within one of the four statutory categories. Claim 26 differs from claim 1 in that it only includes claim 1's "second data" for describing a device-dependent transformation of spatial-information content of a image to a device-independent color space. ('415 Patent 7:8–13.) Claim 26 also adds an additional limitation over claim 1 by defining that the data is represented by spatial-characteristic functions through the "use of spatial stimuli and device response" for the device. ('415 Patent 7:13–15.) But though claim 26 recites verbs "use" and "is represented," this claim is not a process claim; it is a product-by-process claim, "in which the product is defined at least in part in terms of the method or process by which it is made." *SmithKline Beecham Corp. v. Apotex Corp.*, 439 F.3d 1312, 1315 (Fed. Cir. 2006) (internal quotation marks omitted). Product-by-process claims are directed to the ultimate product, and not the underlying process. *Nuijten*, 500 F.3d at 1355. Therefore, claim 26's additional limitation is insufficient to propel the claim into one of the four statutory categories and the claim must be found invalid.

For the same reasons, dependent claims 2–6, 9, and 27–31 cannot rectify the patent-ineligibility problem of their independent claims 1 and 26. These dependent claims only add limitations and make them at most, product-by-process claims. These additional limitations cannot transmute intangible device profiles into patent-eligible subject matter. It follows that these dependent claims must also be found invalid.

C. The device-profile method claims (claims 10–15) do not describe a patent-eligible process because they fail the machine-or-transformation test

Unlike claims 1 and 26, claim 10 is a method claim. Claim 10 describes a method of generating device profiles that closely mirrors claim 1:

> 10. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:
>
> generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;
>
> generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and
>
> combining said first and second data into the device profile.

('415 Patent 6:1–16.)

The parties dispute whether claim 10 falls within the process category of § 101. One important and useful tool to determine whether an invention is a patent-eligible process is the machine-or-transformation test. *Bilski*, 130 S. Ct. at 3227. Though it is not the sole test for patent eligibility, it has been historically true that inventions failing the machine-or-transformation test were rarely granted patents. *Id.* Under this test, a claimed process could be patent-eligible only if "(1) it is tied to a particular machine or apparatus; or (2) it transforms a particular article into a different state or thing." *CyberSource*, 654 F.3d at 1369. But passing this test is no guarantee for patentability; not everything that produces a "useful, concrete, and tangible result" is patentable. *Bilski*, 130 S. Ct. at 3259 (Breyer, J., concurring).

Claim 10 fails the machine prong of this test because it recites no particular machine or apparatus. It is conceivable that this claimed process could be performed by a specialized processor or a general-purpose computer because claim 10 prescribes three separate steps to generate a device profile from preexisting data: (1) generating

first data relating to color information through measured chromatic stimuli and device response characteristic functions; (2) generating second data relating to spatial information through spatial stimuli and device response characteristic functions; and (3) combining the first and second data into a device profile. But even if it is assumed that a processor or computing device plays a central role in this claim, it appears such a device would only be employed for repetitive calculations, and would not "impose meaningful limits on the claim's scope." *CyberSource*, 654 F.3d at 1369; *see Bancorp Servs., L.L.C. v. Sun Life Assurance Co. of Canada (U.S.)*, 687 F.3d 1266, 1278 (Fed. Cir. 2012) (holding that a computer used to manage a stable-value-protected life-insurance policy does not impose meaningful limits on the scope of the claims). Though the "generating" computations may be time-consuming, they are straightforward transfer functions that could be done by pencil-and-paper if the source data is not too complex. Thus, because claim 10 is not tethered to a machine or apparatus (either explicitly or implicitly), claim 10 cannot satisfy the machine prong of the test.

This claimed process fairs no better under the transformation prong. To satisfy this prong, a claimed process must "transform an article into a different state or being." *In re Bilski*, 545 F.3d 943, 962 (Fed. Cir. 2008) (en banc). There is no doubt that this process involves the manipulation of data; some of the mathematical relationships behind these manipulations are provided in the patent specification. ('415 Patent 3:47–4:9, 4:42–64.) But the "mere manipulation or reorganization of data . . . does not satisfy the transformation prong." *CyberSource*, 654 F.3d at 1375. Here, only data is transformed—and it is transformed into different data through mathematical relationships. And though these mathematical relationships may be complex and the data manipulations computationally exhaustive, this does not satisfy the transformation prong. The process of claim 10 mathematically transforms intangible device properties into intangible data describing those properties. This transformation differs from ones that result in an intangible representation of a

physical object. *See In re Bilski*, 545 F.3d at 962 (clarifying that in *Abele*, the "electronic transformation of the data itself into a visual depiction" of body tissues was sufficient to satisfy the transformation prong. *In re Abele*, 684 F.2d at 908–09). Accordingly, claim 10 fails the transformation prong.

D. The device-profile method claims (claims 10–15) are otherwise patent ineligible because they merely describe an abstract idea

Even if claim 10 is deemed a process, the parties differ whether claim 10 merely describes an abstract idea, and is therefore ineligible for patenting. *Bilski*, 130 S. Ct. at 3225. A meaningful exercise is to first identify the abstract idea. *CLS Bank*, 2013 U.S. App. LEXIS 9493, at *33. Here, the abstract idea is the generation of a device profile through mathematical correlations. This was admitted to the Patent Office during prosecution of the patent:

> [W]ith regards to the present invention, to enable optimization, the Applicants developed something referred to as a 'profile' which contains an *abstract description* of the spatial response properties of any device in question (i.e., input device, display device, or output device; noise response and sharpness response).

(Yen Decl., Ex. B, at 120 (emphasis added).)

While an application of an abstract idea, such as a mathematical formula, to a known structure may qualify for patent protection, "to transform an unpatentable [abstract idea] into a patent-eligible *application* of such a law, one must do more than simply state the [abstract idea] while adding the words 'apply it.'" *Mayo*, 132 S. Ct. at 1293–94. Several cases illustrate the § 101 tension between patent-eligible subject matter and an unpatentable abstract idea.

First, in *Benson*, the Supreme Court considered a computer-implemented method for converting binary-coded decimal (BCD) numerals into pure binary numerals. *Gottschalk v. Benson*, 409 U.S. 63, 64 (1972). After identifying the algorithm behind the conversion, the Court concluded that the claims were "so abstract and sweeping as to cover both known and unknown uses of the BCD to pure

binary conversion," and would therefore preclude every application of the algorithm. *Id.* at 68.

Then, in *Flook*, the Supreme Court evaluated the patent eligibility of a computerized method for updating alarm limits for a continuously monitored industrial process. *Parker v. Flook*, 437 U.S. 584, 585–86 (1978). This method involved measuring the present value of a process variable, using the disclosed mathematical formula to calculate a new alarm limit in view of the present value, and adjusting the previous alarm limit to the newly calculated limit. *Id.* at 586–87. The Court concluded that although the claim did not "wholly preempt" the mathematical formula, the claimed process was ineligible for patenting because it was an abstract idea that failed to contain sufficient substance beyond the formula itself. *Id.* at 589, 594.

These two cases can be contrasted with *Diehr*, where the Supreme Court held claims drawn to a process for curing synthetic rubber, using a mathematical formula, to be patent eligible. *Diamond v. Diehr*, 450 U.S. 175, 177 (1981). Although the claimed process incorporated a mathematical formula known as the Arrhenius equation, the process called for substantive steps aside from the equation, such as a step to constantly measure the actual temperature inside the rubber mold. *Id.* at 178–79, 187. This was deemed to be a specific application instead of an abstract idea in isolation, because the patentees "only [sought] to foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process," and not total preemption of the equation. *Id.* at 187.

But claim 10 is nothing more than an abstract idea—it employs algorithms that manipulate collected data. This is not enough: "if a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory." *Flook*, 437 U.S. at 595 (quoting *In re Richman*, 563 F.2d 1026, 1030 (C.C.P.A. 1977)). This broad, structureless claim preempts the entire field of device-independent characterization

paradigms for digital-image processing and cannot be said to be patent-eligible subject matter.

Digitech argues three points in its attempt to show that claim 10 has structural limitations, even though they don't appear in the claim language: first, claim 10 requires an input device such as a camera (Opp'n 23); second, claim 10's required measurements must be done with specialized electronic equipment such as a microdensitometer (*id.* at 23–24); third, the required calculations need a processor because they are nonlinear and must be done in an extremely short amount of time (*id.* at 24). These creative arguments ring hollow.

The Court discounts the first two arguments because claim 10 clearly recites no such structural elements, and claim 10 is written in such a way as to not require any structural elements. The claimed process manipulates incoming color and spatial data, regardless where the data comes from or how the data is captured. And as for Digitech's contention that the claimed process requires a processor because the math is impossible for humans, this argument has been foreclosed by the Federal Circuit: "[S]imply appending generic computer functionality to lend speed or efficiency to the performance of an otherwise abstract concept does not meaningfully limit claim scope for purposes of patent eligibility." *CLS Bank*, 2013 U.S. App. LEXIS 9493, at *29 (citing *Bancorp*, 687 F.3d at 1278, and *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333–34 (Fed. Cir. 2012) (finding that the claimed computer-aided clearinghouse process is a patent-ineligible abstract idea)); *SiRF Tech., Inc. v. Int'l Trade Comm'n*, 601 F.3d 1319, 1333 (Fed. Cir. 2010) ("In order for the addition of a machine to impose a meaningful limit on the scope of a claim, it must play a significant part in permitting the claimed method to be performed, rather than function solely as an obvious mechanism for permitting a solution to be achieved more quickly, i.e., through the utilization of a computer for performing calculations.").

Finally, like claims 1 and 26's dependent claims discussed above, dependent claims 11–15 only limit the type of algorithms that may be employed, such as Wiener

noise power spectra and gray-level dependent noise masks. ('415 Patent 6:21–32.) These dependent claims do not add any meaningful limitations—they are just trivial ones as explained in the specification:

> In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, the characteristic processing section 30 contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. [P]atent [A]pplication Ser. No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation.

('415 Patent 3:14–27.) Thus, these dependent claims cannot salvage an unpatentable principle and transform it into a patentable process. *Mayo*, 132 S. Ct. 1289 at 1302; *Bilski*, 130 S. Ct. at 3230 ("[T]he prohibition against patenting abstract ideas 'cannot be circumvented by attempting to limit the use of the formula to a particular technological environment' or adding 'insignificant postsolution activity.'" (quoting *Diehr*, 450 U.S. at 191–92)).

E. Digitech mischaracterizes its patent claims as ones directed to a digital-image processing system

Throughout its Opposition, Digitech asserts that the claimed invention is a digital-image processing system, either in part or in whole. (Opp'n 6–7, 12–13, 19, 22–23, 24–25.) Though this may be the claimed invention in unasserted claims 18–25, this is not the claimed invention for the asserted claims. The asserted claims recite no structure—it is this deficiency that makes the claims broad and unpatentable.

Having found the asserted claims invalid, the Court declines to opine whether the remaining, unasserted claims are patent ineligible. The Court also recognizes that there may be patentable subject matter disclosed in the '415 Patent, and claims may be drafted (or have been drafted in a related patent) that fully satisfy § 101's eligibility requirements. But this is not the issue here. The asserted claims as drafted in the '415

Patent are intangible, possess no meaningful non-abstract limitations, and are therefore ineligible for patent protection under § 101.

F. Digitech's alleged issues of material fact fail to defeat summary judgment

As a last-ditch effort, Digitech asserts that summary judgment is inappropriate because there are outstanding genuine issues of material fact, and filed a separate Statement of Genuine Disputes of Material Fact. (Opp'n 2–3; ECF No. 73-6.) Not only does Digitech fail to adequately explain what these disputed facts are and how they relate to this § 101 analysis, but most of Digitech's identified issues are not questions of fact—they are questions of law. The remainder of the alleged questions of fact (e.g., whether the claims could be "practiced on a piece of paper" (Statement of Genuine Disputes of Material Fact ¶ 24)) are insignificantly probative to a collateral issue or are entirely irrelevant to this § 101 analysis. As a matter of fact, Digitech's concern is misplaced; determinations of patent eligibility are questions of law. *CyberSource*, 654 F.3d at 1369.

IV. CONCLUSION

As discussed, the Court finds claims 1–6, 9, 10–15, and 26–31 of the '415 Patent invalid under § 101 because they are directed towards patent-ineligible subject matter. Accordingly, Defendants' Motion for Summary Judgment is **GRANTED**.

IT IS SO ORDERED.

July 31, 2013

OTIS D. WRIGHT, II
UNITED STATES DISTRICT JUDGE

(MRWx),APPEAL,CLOSED,DISCOVERY,MANADR,PROTORD,RELATED-G,REOPENED

UNITED STATES DISTRICT COURT for the CENTRAL DISTRICT OF CALIFORNIA (Southern Division - Santa Ana)
CIVIL DOCKET FOR CASE #: 8:12-cv-01324-ODW-MRW

Digitech Image Technologies LLC v. Electronics For Imaging Inc et al Assigned to: Judge Otis D. Wright, II Referred to: Magistrate Judge Michael R. Wilner Related Case: 8:12-cv-01153-ODW-MRW Case in other court: Federal Circuit Court of Appeals, 13-01600 Cause: 35:271 Patent Infringement	Date Filed: 08/16/2012 Date Terminated: 08/06/2013 Jury Demand: Both Nature of Suit: 830 Patent Jurisdiction: Federal Question

Plaintiff

Digitech Image Technologies LLC	represented by	**John J Edmonds** Collins Edmonds Pogorzelski Schlather and Tower PLLC 1851 East First Street Suite 900 Santa Ana, CA 92705 951-708-1237 Fax: 951-824-7901 Email: jedmonds@cepiplaw.com *ATTORNEY TO BE NOTICED* **Joshua B Long** Collins Edmonds Pogorzelski Schlather and Tower PLLC 1616 South Voss Road Suite 125 Houston, TX 77057 281-501-3425 Fax: 832-415-2535 Email: jlong@cepiplaw.com *TERMINATED: 06/07/2013* *PRO HAC VICE* **Stephen F Schlather** Collins Edmonds Pogorzelski Schlather and Tower PLLC 1616 South Voss Road Suite 125 Houston, TX 77057 713-364-2371

Fax: 832-415-2535
Email: sschlather@cepiplaw.com
PRO HAC VICE
ATTORNEY TO BE NOTICED

V.

Movant

LG Electronics Mobilecomm USA Inc *8:13-cv-00134-ODW-MRW*	represented by	**James C Brooks** Orrick Herrington and Sutcliffe LLP 777 South Figueroa Street Suite 3200 Los Angeles, CA 90017 213-629-2020 Fax: 213-612-2499 Email: jbrooks@orrick.com *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Nicholas H Lam** Orrick Herrington and Sutcliffe LLP 51 West 52nd Street New York, NY 10019 212-506-5000 Fax: 212-506-5151 Email: nlam@orrick.com *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED* **Robert M Isackson** Orrick Herrington and Sutcliffe LLP 51 West 52nd Street New York, NY 10019 212-506-5280 Fax: 212-506-5151 Email: Risackson@orrick.com *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED*

V.

Defendant

Electronics For Imaging Inc	represented by	**Edison T Lin** Jones Day

1755 Embarcadero Road
Palo Alto, CA 91303
650-739-3939
Fax: 650-739-3900
Email: elin@jonesday.com
ATTORNEY TO BE NOTICED

Mark L Blake
Jones Day
3161 Michelson Drive Suite 800
Irvine, CA 92612-4408
949-851-3939
Fax: 949-553-7539
Email: mblake@jonesday.com
ATTORNEY TO BE NOTICED

Michelle Stover
Jones Day
3161 Michelson Drive Suite 800
Irvine, CA 92612
949-851-3939
Fax: 949-553-7539
Email: mstover@jonesday.com
ATTORNEY TO BE NOTICED

William C Rooklidge
Jones Day
3161 Michelson Drive Suite 800
Irvine, CA 92612-4408
949-553-7501
Fax: 949-553-7539
Email: wrooklidge@jonesday.com
ATTORNEY TO BE NOTICED

Frank P Cote
Jones Day
3161 Michelson Drive Suite 800
Irvine, CA 92612-4408
949-851-3939
Fax: 949-553-7539
Email: fcote@jonesday.com
ATTORNEY TO BE NOTICED

Defendant

Konica Minolta Holdings Inc *TERMINATED: 10/02/2012*	represented by	**Christopher P Broderick** Orrick Herrington and Sutcliffe LLP 777 South Figueroa Street Suite 3200 Los Angeles, CA 90017 213-629-2020 Fax: 213-612-2499 Email: cbroderick@orrick.com *ATTORNEY TO BE NOTICED*

Defendant

Konica Minolta Holdings USA Inc *TERMINATED: 10/02/2012*	represented by	**Christopher P Broderick** (See above for address) *ATTORNEY TO BE NOTICED*

Defendant

Konica Minolta Business Solutions USA Inc *TERMINATED: 10/02/2012*	represented by	**Christopher P Broderick** (See above for address) *ATTORNEY TO BE NOTICED*

Defendant

Xerox Corporation *TERMINATED: 10/02/2012*	represented by	**Anthony Ross Delling** Pillsbury Winthrop Shaw Pittman LLP 725 S Figueroa St, Ste 2800 Los Angeles, CA 90017-5406 213-488-7100 Fax: 213-629-1033 Email: anthony.delling@pillsburylaw.com *ATTORNEY TO BE NOTICED*

Defendant

Panasonic Corporation *8:12-cv-01667-ODW-MRW* *TERMINATED: 07/26/2013*	represented by	**Christopher P Broderick** Orrick Herrington and Sutcliffe LLP 777 South Figueroa Street Suite 3200 Los Angeles, CA 90017 213-629-2020 Fax: 213-612-2499 Email: cbroderick@orrick.com *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Steven J Routh** Orrick Herrington and Sutcliffe LLP 1152 - 15th Street NW Washington, DC 20005-1706

202-339-8400
Fax: 202-339-8500
Email: srouth@orrick.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Defendant

Panasonic Corporation of North America
8:12-cv-01667-ODW-MRW
TERMINATED: 07/26/2013

represented by

Christopher P Broderick
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Steven J Routh
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Defendant

Buy.Com Inc
8:12-cv-01668-ODW-MRW

represented by

Gregory S Tamkin
Dorsey & Whitney
1400 Wewatta Street, Suite 400
Denver, CO 80202-5549
303-629-3400
Email: tamkin.greg@dorsey.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Canon Inc.
8:12-cv-01670-ODW-MRW

represented by

Christopher P Broderick
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Joseph A Calvaruso
Orrick Herrington and Sutcliffe LLP
51 West 52nd Street
New York, NY 10019-6142
212-506-5140
Fax: 212-506-5151
Email: jcalvaruso@orrick.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Defendant

Best Buy Co Inc *8:12-cv-01669-ODW-MRW* *TERMINATED: 07/16/2013*	represented by	**Bryan J Mechell** Robins Kaplan Miller and Ciresi LLP 800 LaSalle Avenue Minneapolis, MN 55402 612-349-8500 Fax: 612-339-4181 Email: BJMechell@rkmc.com *TERMINATED: 04/23/2013* *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED* **Christopher K Larus** Robins Kaplan Miller and Ciresi LLP 800 LaSalle Avenue Minneapolis, MN 55402 612-349-8500 Fax: 612-339-4181 Email: CKLarus@rkmc.com *TERMINATED: 04/23/2013* *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED* **Christopher P Broderick** (See above for address) *ATTORNEY TO BE NOTICED*

Defendant

B and H Foto and Electronics Corp	represented by	**Aaron Stiefel** Kaye Scholer LLP 425 Park Avenue New York, NY 10022-3598 212-836-8000 Fax: 212-836-8689 Email: Aaron.stiefel@kayescholer.com *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED* **David Moffat Harris** Kaye Scholer LLP

425 Park Avenue
New York, NY 10022
212-836-8000
Fax: 212836-8689
Email: david.harris@kayescholer.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Oscar Ramallo
Kaye Scholer LLP
1999 Avenue of the Stars Suite 1700
Los Angeles, CA 90067
310-788-1000
Fax: 310-788-1200
Email: oscar.ramallo@kayescholer.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Rhonda R Trotter
Kaye Scholer LLP
1999 Avenue of the Stars Suite 1700
Los Angeles, CA 90067
310-788-1000
Fax: 310 788 1200
Email: rtrotter@kayescholer.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Sakar International Inc
8:12-cv-01673-ODW-MRW
doing business as
Vivitar

represented by

Ezra Sutton
Ezra Sutton PA
900 Route 9 Suite 201
Woodbridge, NJ 07095
732-634-3520
Fax: 732-634-3511
Email: esutton@ezrasutton.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Kambiz Tom Kohan
Kohan Law Firm
445 South Figueroa Street 27th Floor
Los Angeles, CA 90071

310-349-1111
Fax: 213-612-7715
Email: tom@kohanlawfirm.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Mamiya Digital Imaging Co., LTD *8:12-cv-01675-ODW-MRW*	represented by	**Erikson Christopher Squier** Greenberg Traurig LLP 3161 Michelson Drive Suite 1000 Irvine, CA 92612 949-732-6572 Fax: 949-732-6501 Email: squiere@gtlaw.com *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **J Rick Tache** Greenberg Traurig LLP 3161 Michelson Drive Suite 1000 Irvine, CA 92612 949-732-6500 Fax: 949-732-6501 Email: tacher@gtlaw.com *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Jenny S Kim** Greenberg Traurig LLP 3161 Michelson Drive Suite 1000 Irvine, CA 92612 949-732-6500 Fax: 949-732-6501 Email: kimje@gtlaw.com *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED*

Defendant

Leaf Imaging Ltd *8:12-cv-01675-ODW-MRW* *doing business as* Mamiyaleaf	represented by	**J Rick Tache** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED*

Defendant

Mamiya America Corporation	represented by	**Erikson Christopher Squier**

8:12-cv-01675-ODW-MRW

(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

J Rick Tache
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Jason Blake Cunningham
Greenberg Traurig LLP
4 Embarcadero Center Suite 3000
San Francisco, CA 94111-5983
415-655-1300
Fax: 415-707-2010
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Jenny S Kim
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Richard D Harris
Greenberg Traurig LLP
77 West Wacker Drive Suite 3100
Chicago, IL 60601
312-456-8400
Fax: 312-456-8435
Email: HarrisR@gtlaw.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Defendant

Olympus Corporation
8:12-cv-01676-ODW-MRW

represented by **Christopher P Broderick**
(See above for address)
ATTORNEY TO BE NOTICED

Defendant

Olympus Imaging America Inc.
8:12-cv-01676-ODW-MRW

represented by **Christopher P Broderick**
(See above for address)
ATTORNEY TO BE NOTICED

Defendant

Leica Camera AG *8:12-cv-01677-ODW-MRW*	represented by	**Daniel A Sasse** Crowell and Moring LLP 3 Park Plaza 20th Floor Irvine, CA 92614 949-263-8400 Fax: 949-263-8414 Email: dsasse@crowell.com *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Michael H Jacobs** Crowell and Moring LLP 1001 Pennsylvania Avenue NW Washington, DC 20004-2595 202-624-2500 Fax: 202-628-5116 Email: mjacobs@crowell.com *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED*

Defendant

Leica Camera Inc. *8:12-cv-01677-ODW-MRW*	represented by	**Daniel A Sasse** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Michael H Jacobs** (See above for address) *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED*

Defendant

Sony Corporation *8:12-cv-01678-ODW-MRW* *TERMINATED: 07/08/2013*	represented by	**Lauren J Dreyer** Finnegan Henderson Farabow Garrett and Dunner LLP New York Avenue NW Washington, DC 20001-4413 202-408-4000 Fax: 202-408-4400 Email: lauren.dreyer@finnegan.com *LEAD ATTORNEY* *PRO HAC VICE*

ATTORNEY TO BE NOTICED

Lionel M Lavenue
Finnegan Henderson Farabow Garrett and Dunner LLP
11955 Freedom Drive Two Freedom Square
Reston, VA 20190
571-203-2700
Fax: 202-408-4400
Email: lionel.lavenue@finnegan.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Michael C Elmer
Finnegan Henderson Farabow Garrett and Dunner LLP
2 Overlook Drive
Newport Beach, CA 92657
949-715-5263
Fax: 650-849-6666
Email: michael.elmer@finnegan.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Sony Corporation of America
8:12-cv-01678-ODW-MRW
TERMINATED: 07/08/2013

represented by

Lauren J Dreyer
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Lionel M Lavenue
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Michael C Elmer
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Fujifilm Corporation *8:12-cv-01679-ODW-MRW*	represented by	**Steven J Routh** (See above for address) *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED* **Christopher P Broderick** (See above for address) *ATTORNEY TO BE NOTICED*

Defendant

General Imaging Company *8:12-cv-01680-ODW-MRW*	represented by	**Damien James Howard** Knobbe Martens Olson & Bear LLP 2040 Main St 14th Floor Irvine, CA 92614 949-721-5378 Fax: 949-760-9502 *TERMINATED: 07/10/2013* *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Jon W Gurka** Knobbe Martens Olson and Bear LLP 2040 Main Street 14th Floor Irvine, CA 92614 949-760-0404 Fax: 949-760-9502 Email: jon.gurka@knobbe.com *TERMINATED: 07/10/2013* *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Joshua M Masur** Turner Boyd LLP 2570 West El Camino Real Suite 380 Mountain View, CA 94040 650-521-5930 Fax: 650-521-5931 Email: masur@turnerboyd.com *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Reza Mirzaie** Knobbe Martens Olson and Bear LLP 10100 Santa Monica Boulevard Suite 1600

Los Angeles, CA 90067
310-551-3450
Fax: 310-551-3458
Email: litigation@kmob.com
TERMINATED: 07/10/2013
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Zhuanjia Gu
Turner Boyd LLP
2570 West El Camino Real Suite 380
Mountain View, CA 94040
650-521-5930
Fax: 650-521-5931
Email: gu@turnerboyd.com
ATTORNEY TO BE NOTICED

Defendant

Sigma Corporation
8:12-cv-01681-ODW-MRW

represented by **Christopher P Broderick**
(See above for address)
ATTORNEY TO BE NOTICED

Defendant

Sigma Corporation of America
8:12-cv-01681-ODW-MRW

represented by **Christopher P Broderick**
(See above for address)
ATTORNEY TO BE NOTICED

Defendant

Target Corporation
8:12-cv-01683-ODW-MRW
TERMINATED: 07/17/2013

represented by **Christopher P Broderick**
(See above for address)
ATTORNEY TO BE NOTICED

Defendant

Nikon Corporation
8:12-cv-01685-ODW-MRW

represented by **Steven J Routh**
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Christopher P Broderick
(See above for address)
ATTORNEY TO BE NOTICED

Defendant

Micro Electronics Inc

represented by **Christopher P Broderick**

8:12-cv-01686-ODW-MRW
doing business as
Micro Center, -

(See above for address)
ATTORNEY TO BE NOTICED

Defendant

Newegg Inc.
8:12-cv-01688-ODW-MRW

represented by **Annette Kazmerski**
Newegg Inc
16839 East Gale Avenue
City of Industry, CA 91745
626-271-9700
Fax: 626-271-9480
Email: Annette.A.Kazmerski@Newegg.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Cecilia Dickson
The Webb Law Firm
420 Ft Duquesne Boulevard Suite 1200
Pittsburgh, PA 15222
412-471-8815
Fax: 412-471-4094
Email: cdickson@webblaw.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Kent E Baldauf , Jr
The Webb Law Firm
420 Ft Duquesne Boulevard Suite 1200
Pittsburgh, PA 15222
412-471-8815
Fax: 412-471-4094
Email: kbaldaufjr@webblaw.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Defendant

Pentax Ricoh Imaging Co Ltd
8:12-cv-01689-ODW-MRW

represented by **Bruce D Kuyper**
Bingham McCutchen LLP
1601 Cloverfield Blvd Ste 2050N
Santa Monica, CA 90404-4032
310-255-9080
Fax: 310-907-2080

Email: bruce.kuyper@bingham.com
TERMINATED: 06/14/2013
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Patrick S Park
DLA Piper
2000 Avenue of the Stars Suite 400
Los Angeles, CA 90067
310-595-3000
Fax: 310-595-3300
Email: patrick.park@dlapiper.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Richard DeBodo
Bingham McCutchen LLP
1601 Cloverfield Boulevard Suite 2050
North
Santa Monica, CA 90404-4082
310-907-1000
Fax: 310-907-2000
Email: rich.debodo@bingham.com
TERMINATED: 06/14/2013
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Christopher P Broderick
(See above for address)
ATTORNEY TO BE NOTICED

Defendant

Xerox Corporation
8:12-cv-01693-ODW-MRW

represented by **Jason P Grier**
Ballard Spahr LLP
999 Peachtree Street NE Suite 1000
Atlanta, GA 30309-3915
678-420-9300
Fax: 678-420-9301
Email: grierj@ballardspahr.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Katrina M Quicker
Ballard Spahr LLP

999 Peachtree Street NE Suite 1000
Atlanta, GA 30309
678-420-9330
Fax: 678-420-9301
Email: quickerk@ballardspahr.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Michael J Riesen
Ballard Spahr LLP
999 Peachtree Street Suite 1000
Atlanta, GA 30309
678-4201-9530
Fax: 678-420-9301
Email: riesenm@ballardspahr.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Richard William Miller
Ballard Spahr LLP
999 Peachtree Street NE Suite 1000
Atlanta, GA 30309-3915
678-420-9300
Fax: 678-420-9301
Email: millerrw@ballardspahr.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Rosina Maria Hernandez
Ballard Spahr LLP
2029 Century Park East Suite 800
Los Angeles, CA 90067-2909
424-204-4400
Fax: 424-204-4350
Email: hernandezr@ballardspahr.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Konica Minolta Holdings USA Inc
8:12-cv-01694-ODW-MRW

represented by **Christopher P Broderick**
(See above for address)
ATTORNEY TO BE NOTICED

Defendant

CDW LLC represented by **Anthony S Gabrielson**
Marshall Gerstein and Borun LLP
233 South Wacker Drive 6300 Willis Tower
Chicago, IL 60606-6357
312-474-6300
Fax: 312-474-0448
Email: agabrielson@marshallip.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Frederick S Chung
Gibson Dunn and Crutcher LLP
1881 Page Mill Road
Palo Alto, CA 94304
650-849-5300
Fax: 650-849-5333
Email: fchung@gibsondunn.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

John Nolan Carter
Gibson Dunn and Crutcher LLP
3161 Michelson Drive
Irvine, CA 92612-4412
949-451-3800
Fax: 949-451-4220
Email: jcarter@gibsondunn.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Tiffany D Gehrke
Marshall Gerstein and Borun LLP
233 South Wacker Drive 6300 Willis Tower
Chicago, IL 60606-6357
312-474-6300
Fax: 312-474-0448
Email: tgehrke@marshallip.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Defendant

Victor Hasselblad AB *8:12-cv-01696-ODW-MRW*	represented by	**Gregory S Cordrey** Jeffer Mangels Butler and Mitchell LLP 3 Park Plaza Suite 1100 Irvine, CA 92614 949-623-7200 Fax: 949-623-7202 Email: GCordrey@jmbm.com *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Kyle Bradford Fleming** Renner Otto Boisselle and Sklar 1621 Euclid Avenue, 19th Floor Cleveland, OH 44115 216-736-3114 Email: kfleming@rennerotto.com *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Mark C Johnson** Renner Otto Boisselle and Sklar LLP 1621 Euclid Avenue 19th Floor Cleveland, OH 44115 216-621-1113 Fax: 216-621-6165 Email: mjohnson@rennerotto.com *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED*

Defendant

Casio Computer Co Ltd *8:12-cv-01697-ODW-MRW*	represented by	**David Chunyi Lee** Sills Cummis and Gross PC 30 Rockefeller Plaza New York, NY 10112 212-643-7000 Fax: 212-643-6500 Email: dlee@sillscummis.com *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED* **Jennifer R Bagosy**

Morgan Lewis and Bockius LLP
5 Park Plaza Suite 1750
Irvine, CA 92614
949-399-7000
Fax: 949-399-7001
Email: jbagosy@morganlewis.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Katherine M Lieb
Sills Cummis and Gross PC
30 Rockefeller Plaza
New York, NY 10112
212-643-7000
Fax: 212-643-6500
Email: klieb@sillscummis.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Mario Moore
Morgan, Lewis and Bockius LLP
5 Park Plaza Suite 1750
Irvine, CA 92614-8557
949-399-7000
Fax: 949-399-7001
Email: mario.moore@morganlewis.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Michael J Lyons
Morgan Lewis and Bockius LLP
2 Palo Alto Square
3000 El Camino Real
Palo Alto, CA 94306-2122
650-843-4000
Fax: 650-843-4001
Email: mlyons@morganlewis.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Scott D Stimpson
Sills Cummis and Gross PC
30 Rockefeller Plaza
New York, NY 10112

212-643-7000
Fax: 212-643-6500
Email: sstimpson@sillscummis.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Defendant

Asus Computer International
8:12-cv-02122-ODW-MRW

represented by **Joshua M Masur**
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Asustek Computer Inc
8:12-cv-02122-ODW-MRW

represented by **Joshua M Masur**
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Motorola Mobility LLC
8:12-cv-02123-ODW-MRW
TERMINATED: 07/11/2013
Substituted for
Motorola Mobility Inc
TERMINATED: 07/11/2013

represented by **Gary L Bostwick**
Bostwick and Jassy LLP
12400 Wilshire Boulevard Suite 400
Los Angeles, CA 90025
310-979-6059
Fax: 310-314-8401
Email: gbostwick@bostwickjassy.com
TERMINATED: 07/11/2013
LEAD ATTORNEY

Geoffrey K Gavin
Kilpatrick Townsend and Stockton LLP
1100 Peachtree Street NE Suite 2800
Atlanta, GA 90309-4530
404-815-6046
Fax: 404-815-6555
Email: ggavin@kilpatricktownsend.com
TERMINATED: 07/11/2013
LEAD ATTORNEY
PRO HAC VICE

Mitchell G Stockwell
Kilpatrick Townsend and Stockton LLP
1100 Peachtree Street Suite 2800
Altanta, GA 30309-4530

404-815-6214
Fax: 404-541-3403
Email:
Mstockwell@kilpatricktownsend.com
TERMINATED: 07/11/2013
LEAD ATTORNEY
PRO HAC VICE

Robert S Dailey
Kilpatrick Townsend and Stockton LLP
607 Fourteenth Street NW
Washington, DC 20005-2018
202-508-5800
Fax: 202-508-5858
Email: rdailey@kilpatricktownsend.com
TERMINATED: 07/11/2013
LEAD ATTORNEY
PRO HAC VICE

Taylor Higgins Ludlam
Kilpatrick Townsend and Stockton LLP
4208 Six Forks Road Suite 1400
Raleigh, NC 27609
919-420-1705
Fax: 919-510-6141
Email: taludlam@kilpatricktownsend.com
TERMINATED: 07/11/2013
LEAD ATTORNEY
PRO HAC VICE

Defendant

Apple Inc.
8:12-cv-02125-ODW-MRW
TERMINATED: 04/17/2013

represented by

Frank P Cote
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Mark A Finkelstein
Jones Day
3161 Michelson Drive Suite 800
Irvine, CA 92612-4408
949-851-3939
Fax: 949-553-7539
Email: mafinkelstein@jonesday.com
LEAD ATTORNEY

ATTORNEY TO BE NOTICED

William C Rooklidge
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Acer America Corporation
8:12-cv-02126-ODW-MRW
TERMINATED: 07/05/2013

represented by **Hsiang H Lin**
TechKnowledge Law Group LLP
1521 Diamond St
San Francisco, CA 94131
415-816-9525
Email: jlin@techknowledgelaw.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Jerry Chen
Freitas Tseng and Kaufman LLP
100 Marine Parkway Suite 200
Redwood City, CA 94065
650-593-6300
Fax: 650-593-6301
Email: jchen@ftklaw.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Michael C Ting
Freitas Tseng Baik & Kaufman LLP
100 Marine Parkway Suite 200
Redwood Shores, CA 94065
650-593-6300
Fax: 650-593-6301
Email: mting@ftbklaw.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Acer Inc.
8:12-cv-02126-ODW-MRW
TERMINATED: 07/05/2013

represented by **Hsiang H Lin**
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Jerry Chen
(See above for address)

LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Michael C Ting
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Toshiba Corporation
8:12-cv-02127-ODW-MRW

represented by

Douglas F Stewart
Dorsey and Whitney LLP
701 Fifth Avenue Suite 6100
Seattle, WA 98104
206-903-8800
Fax: 206-903-8820
Email: stewart.douglas@dorsey.com
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Katherine J Santon
Dorsey and Whitney LLP
600 Anton Boulevard Suite 2000
Costa Mesa, CA 92626
714-800-1400
Fax: 714-464-4436
Email: santon.kate@dorsey.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Kent J Schmidt
Dorsey and Whitney LLP
600 Anton Boulevard Suite 2000
Costa Mesa, CA 92626
714-800-1400
Fax: 714-800-1499
Email: schmidt.kent@dorsey.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Paul T Meikeljohn
Dorsey and Whitney LLP
701 Fifth Avenue Suite 6100
Seattle, WA 98104
206-903-8746

Email: meiklejohn.paul@dorsey.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

Toshiba America Inc.
8:12-cv-02127-ODW-MRW

represented by **Douglas F Stewart**
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Katherine J Santon
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Kent J Schmidt
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Paul T Meikeljohn
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Defendant

LG Electronics USA Inc
8:13-cv-00134-ODW-MRW

represented by **James C Brooks**
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Nicholas H Lam
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Robert M Isackson
(See above for address)
LEAD ATTORNEY
PRO HAC VICE
ATTORNEY TO BE NOTICED

Defendant

LG Electronics Inc. *8:13-cv-00134-ODW-MRW*	represented by	**James C Brooks** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED* **Nicholas H Lam** (See above for address) *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED* **Robert M Isackson** (See above for address) *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED*

Defendant

HTC America Inc *8:13-cv-00135-ODW-MRW* *TERMINATED: 04/30/2013*	represented by	**Reza Mirzaie** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED*

Defendant

HTC Corp *8:13-cv-00135-ODW-MRW* *TERMINATED: 04/30/2013* *also known as* High Tech Computer Corp *TERMINATED: 04/30/2013*	represented by	**Reza Mirzaie** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED*

Defendant

HTC BVI Corp *8:13-cv-00135-ODW-MRW* *TERMINATED: 04/30/2013*	represented by	**Reza Mirzaie** (See above for address) *LEAD ATTORNEY* *ATTORNEY TO BE NOTICED*

Defendant

Toshiba America Business Solutions Inc *8:12-cv-02127-ODW-MRW*	represented by	**Douglas F Stewart** (See above for address) *LEAD ATTORNEY* *PRO HAC VICE* *ATTORNEY TO BE NOTICED* **Katherine J Santon**

(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Kent J Schmidt
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Paul T Meikeljohn
(See above for address)
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

V.

Estate Defendant

Overstock.com Inc
8:12-cv-01687-ODW-MRW

represented by **Christopher P Broderick**
(See above for address)
ATTORNEY TO BE NOTICED

Counter Defendant

Acacia Research Corporation
8:12-cv-01688-ODW-MRW

represented by **Karla J Kraft**
Hodel Briggs Winter LLP
8105 Irvine Center Drive Suite 1400
Irvine, CA 92618
949-450-8040
Fax: 949-450-8033
Email: kkraft@hbwllp.com
LEAD ATTORNEY
ATTORNEY TO BE NOTICED

Date Filed	#	Docket Text
08/16/2012	1	COMPLAINT against Defendants Electronics For Imaging Inc, Konica Minolta Business Solutions USA Inc, Konica Minolta Holdings Inc, Konica Minolta Holdings USA Inc and Xerox Corporation. Case assigned to Judge James V. Selna for all further proceedings. Discovery referred to Magistrate Judge Robert N. Block.(Filing fee $350 Paid). Jury Demanded. Filed by Plaintiff Digitech Image Technologies LLC.(lwag) (lwag). (Entered: 08/17/2012)
08/16/2012		21 DAY Summons Issued re Complaint - (Discovery), Complaint - (Discovery) 1 as to Defendants Electronics For Imaging Inc, Konica Minolta Business Solutions USA Inc, Konica Minolta Holdings Inc, Konica Minolta Holdings USA Inc and Xerox Corporation. (lwag) (Entered: 08/17/2012)

08/16/2012	2	CERTIFICATION and Notice of Interested Parties filed by Plaintiff Digitech Image Technologies LLC. (lwag) (lwag). (Entered: 08/17/2012)
08/16/2012	3	NOTICE TO COUNSEL RE: Copyright, Patent and Trademark Reporting Requirements. Counsel shall file the appropriate AO-120 and/or AO-121 form with the Clerk within 10 days. (lwag) (Entered: 08/17/2012)
08/16/2012	4	NOTICE TO PARTIES OF COURT-DIRECTED ADR PROGRAM filed.(lwag) (Entered: 08/17/2012)
08/21/2012	5	REPORT ON THE FILING OF AN ACTION Regarding a Patent or a Trademark (Initial Notification) filed by Digitech Image Technologies LLC. (Edmonds, John) (Entered: 08/21/2012)
08/27/2012	6	INITIAL ORDER FOLLOWING FILING OF COMPLAINT ASSIGNED TO JUDGE SELNA. (jlen) (Entered: 08/27/2012)
08/28/2012	7	ORDER SETTING RULE 26(f) SCHEDULING CONFERENCE by Judge James V. Selna. Scheduling Conference set for 12/17/2012 11:30 AM before Judge James V. Selna. (Attachments: # 1 Exhibit) (jlen) (Entered: 08/28/2012)
08/30/2012	8	NOTICE filed by Plaintiff Digitech Image Technologies LLC. *Digitech Image Technologies, LLC's Notice of Related Cases Per Local Rule 83-1.3* (Schlather, Stephen) (Entered: 08/30/2012)
09/05/2012	9	STIPULATION Extending Time to Answer the complaint as to Electronics For Imaging Inc answer now due 10/12/2012, re Complaint - (Discovery), Complaint - (Discovery) 1 filed by Defendant Electronics For Imaging Inc.(Cote, Frank) (Entered: 09/05/2012)
09/07/2012	10	STIPULATION Extending Time to Answer the complaint as to Xerox Corporation answer now due 10/12/2012, filed by Defendant Xerox Corporation.(Delling, Anthony) (Entered: 09/07/2012)
09/11/2012	11	NOTICE of Appearance filed by attorney Christopher P Broderick on behalf of Defendants Konica Minolta Business Solutions USA Inc, Konica Minolta Holdings Inc, Konica Minolta Holdings USA Inc (Broderick, Christopher) (Entered: 09/11/2012)
09/11/2012	12	Joint STIPULATION for Extension of Time to File Answer to 11/12/2012 re Complaint - (Discovery), Complaint - (Discovery) 1 filed by Defendants Konica Minolta Business Solutions USA Inc, Konica Minolta Holdings Inc, Konica Minolta Holdings USA Inc. (Attachments: # 1 Proposed Order)(Broderick, Christopher) (Entered: 09/11/2012)
09/11/2012	13	ORDER by Judge James V. Selna: Granting Stipulation to Extend Time to Answer 12 : Defendants Konica Minolta Business Solutions USA Inc answer due 11/12/2012; Konica Minolta Holdings Inc answer due 11/12/2012; Konica Minolta Holdings USA Inc answer due 11/12/2012. (rla) (Entered: 09/13/2012)
09/14/2012	26	APPLICATION for attorney Joshua Long to Appear Pro Hac Vice. (PHV FEE PAID.) filed by plaintiff Digitech Image Technologies LLC. (ak) (Entered: 10/29/2012)

09/14/2012	27	APPLICATION for attorney Stephen Schlather to Appear Pro Hac Vice. (PHV FEE PAID.) filed by plaintiff Digitech Image Technologies LLC. (ak) (Entered: 10/29/2012)
09/25/2012	14	CORPORATE DISCLOSURE STATEMENT filed by Plaintiff Digitech Image Technologies LLC (Edmonds, John) (Entered: 09/25/2012)
10/02/2012	15	NOTICE OF DISMISSAL filed by Plaintiff Digitech Image Technologies LLC pursuant to FRCP 41a(1) as to Konica Minolta Business Solutions USA Inc, Konica Minolta Holdings Inc, Konica Minolta Holdings USA Inc. (Edmonds, John) (Entered: 10/02/2012)
10/02/2012	16	NOTICE OF DISMISSAL filed by Plaintiff Digitech Image Technologies LLC pursuant to FRCP 41a(1) as to Xerox Corporation. (Edmonds, John) (Entered: 10/02/2012)
10/02/2012	17	NOTICE of Related Case(s) filed by Plaintiff Digitech Image Technologies LLC. (Edmonds, John) (Entered: 10/02/2012)
10/03/2012	18	ANSWER to Complaint - (Discovery), Complaint - (Discovery) 1 with JURY DEMAND filed by defendant Electronics For Imaging Inc.(Cote, Frank) (Entered: 10/03/2012)
10/03/2012	19	*Certification and Notice* of Interested Parties filed by defendant Electronics For Imaging Inc, identifying Digitech Image Technologies, LLC, Electronics For Imaging, Inc.. (Cote, Frank) (Entered: 10/03/2012)
10/03/2012	20	CORPORATE DISCLOSURE STATEMENT filed by Defendant Electronics For Imaging Inc identifying Electronic For Imaging, Inc. as Corporate Parent. (Cote, Frank) (Entered: 10/03/2012)
10/04/2012	21	NOTICE of Appearance filed by attorney Frank P Cote on behalf of Defendant Electronics For Imaging Inc (Cote, Frank) (Entered: 10/04/2012)
10/08/2012	22	NOTICE of Related Case(s) filed by Plaintiff Digitech Image Technologies LLC. *Plaintiff Digitech Image Technologies, LLC's Amended Notice of Related Cases Per Local Rule 83-1.3* (Edmonds, John) (Entered: 10/08/2012)
10/12/2012	23	ORDER RE TRANSFER PURSUANT TO GENERAL ORDER 08-05 -Related Case- filed. Related Case No: SACV12-01153 ODW (MRWx). Case transferred from Magistrate Judge Robert N. Block and Judge James V. Selna to Judge Otis D Wright, II and Magistrate Judge Michael R. Wilner for all further proceedings. The case number will now reflect the initials of the transferee Judge SACV12-01324 ODW (MRWx). Signed by Judge Otis D Wright, II. (dro) (Entered: 10/16/2012)
10/15/2012	24	MINUTE ORDER IN CHAMBERS by Judge Otis D Wright, II: Counsel are encouraged to review the Central Districts website for additional information. The address is "http://www.cacd.uscourts.gov". It is not necessary to clear a motion date with the Court Clerk prior to filing the motion. The Court hears motions on Mondays, Criminal at 10:00 a.m. and Civil at 1:30 p.m. SEE ORDER FOR FURTHER DETAILS. (jre) (Entered: 10/16/2012)
10/16/2012	25	MINUTE ORDER IN CHAMBERS by Judge Otis D Wright, II: This action has been

		reassigned to the Honorable Otis D. Wright II, United States DistrictJudge. The magistrate judges assignment has been changed to the Honorable Michael R.Wilner.Please substitute the initials ODW(MRWx) in place of the initials JVS (RNBx). Thecase number will now read: SA CV 12-01324- ODW(MRWx). Henceforth, it isimperative that the initials ODW(MRWx) be used on all documents to prevent delays in the processing of documents. The Courtroom Deputy Clerk for Judge Wright is Sheila English. She can be reached at (213) 894-8266. Judge Wrights courtroom is located on the Spring Street level of the Spring Street Courthouse, Courtroom 11. Additional information about Judge Wright's procedures can be found on the Courts website at www.cacd.uscourts.gov > Judges Procedures & Schedules. (jre) (Entered: 10/16/2012)
10/25/2012	28	ORDER by Judge Otis D Wright, II: granting 27 Application to Appear Pro Hac Vice by Attorney Stephen F. Schlather on behalf of Plaintiff, designating John J. Edmonds as local counsel. (lt) Modified on 10/30/2012 (lt). (Entered: 10/30/2012)
10/25/2012	29	ORDER by Judge Otis D Wright, II: granting 26 Application to Appear Pro Hac Vice by Attorney Joshua B. Long on behalf of Plaintiff, designating John J. Edmonds as local counsel. (lt) (Entered: 10/30/2012)
10/30/2012	30	NOTICE TO FILER OF DEFICIENCIES in Electronically Filed Documents RE: APPLICATION for attorney Stephen Schlather to Appear Pro Hac Vice. (PHV FEE PAID.) 27 , APPLICATION for attorney Joshua Long to Appear Pro Hac Vice. (PHV FEE PAID.) 26 . The following error(s) was found: A Certification of Good Standing is not attached to Pro Hac Vice Application. Certificates of Good Standing have been required since 9/08. See LR 83-2.3.1. Other error(s) with document(s) are specified below. Other error(s) with document(s): No signatures on Applications. Applicants did not sign the application. See LR 11-1. In response to this notice the court may order (1) an amended or correct document to be filed (2) the document stricken or (3) take other action as the court deems appropriate. You need not take any action in response to this notice unless and until the court directs you to do so. (lt) (Entered: 10/30/2012)
11/07/2012	31	ORDER by Judge Otis D Wright, II: Because this case has been transferred to this Court, Judge Selnas order setting a Rule 26(f) scheduling conference for December 17, 2012, is hereby VACATED 7 . An order setting a new scheduling conference date will issue shortly. (lc) (Entered: 11/07/2012)
11/07/2012	32	ORDER that the Scheduling Conference is set for 1/14/2013 01:30 PM ; compliance with FRCP 16, and 26(f) and filing of joint report; Counsel for plaintiff shall immediately serve this Order on all parties, including any new parties to the action by Judge Otis D Wright, II (lc) (Entered: 11/08/2012)
12/27/2012	33	ORDER by Judge Otis D Wright, II: The scheduling conference in this matter, currently for January 14, 2012, is hereby CONTINUED to April 1, 2013. The parties joint Rule 26(f) conference is therefore due no later than March 18, 2013. (lc). Modified on

		12/28/2012 (lc). (Entered: 12/28/2012)
12/31/2012	34	Joint STIPULATION for Protective Order filed by Plaintiff Digitech Image Technologies LLC. (Attachments: # 1 Proposed Order, # 2 Exhibit Comparison w/ NDCal Standard Order)(Edmonds, John) (Entered: 12/31/2012)
01/03/2013	35	STIPULATED PROTECTIVE ORDER 34 by Judge Otis D Wright, II (lc) (Entered: 01/03/2013)
01/14/2013	36	NOTICE of Appearance filed by attorney Edison T Lin on behalf of Defendant Electronics For Imaging Inc (Lin, Edison) (Entered: 01/14/2013)
03/18/2013	37	JOINT REPORT Rule 26(f) Discovery Plan ; estimated length of trial 7 days, filed by Plaintiff Digitech Image Technologies LLC.. (Attachments: # 1 Appendix A, # 2 Exhibit 1, # 3 Exhibit 2, # 4 Exhibit 3, # 5 Exhibit 4)(Edmonds, John) (Entered: 03/18/2013)
03/26/2013	38	PATENT STANDING ORDER by Judge Otis D. Wright, II, (lc) (Entered: 03/26/2013)
04/01/2013	39	MINUTES OF Scheduling Conference held before Judge Otis D. Wright, II:The Digitech Cases are, until further order, coordinated for case-management purposes under Federal Rule of Civil Procedure 42.The parties are hereby ORDERED to file a joint brief addressing their respective positions on the protective and electronically-stored information orders to be issued in this case. The joint brief shall not exceed 20 pages in length(excluding exhibits) and shall be filed no later than April 15, 2013. In addition, the stipulated protective order filed in Digitech Image Technologies LLC v. Electronics for Imaging, Inc., No. 8:12-cv-01324, ECF No. 35 (C.D. Cal. filed Jan. 1, 2013), is hereby VACATED. That order will be replaced with a forthcoming protective order applicable in all of these The low-number case, Digitech Image Technologies LLC v. Electronics for Imaging, Inc., No. 8:12-cv-01324-ODW-MRW (C.D. Cal. filed Aug. 16, 2012), will serve as the master case file. All orders, pleadings, motions, and other documents will, when filed and docketed in the master case file, be deemed filed and docketed in each individual related case to the extent applicable. Parties shall enter their appearances in the individual cases, and the Clerk is directed to add all parties and attorneys from the individual cases to the master case file such that all counsel appearing in the individual cases will receive notifications for the master case file as well.consolidated cases.The Cases Against the Retailer Defendants are Hereby Stayed. The Court hereby GRANTS the following retailer Defendants motions to stay: Digitech Image Tech. LLC v. Buy.com, No. 8:12-cv-01668, ECF No. 13 Digitech Image Tech. LLC v. Best Buy Co., No. 8:12-cv-01669, ECF No. 19 Digitech Image Tech. LLC v. B&H Foto & Elec. Corp., No. 8:12-cv-01671, ECF No. 18 Digitech Image Tech. LLC v. Target Corp., No. 8:12-cv-01683, ECF No. 16 Digitech Image Tech. LLC v. Micro Elec. Inc., No. 8:12-cv-01686, ECF No. 16Digitech Image Tech. LLC v. Overstock.com, No. 8:12-cv-01687, ECF No. 16 Digitech Image Tech. LLC v. Newegg Inc., No. 8:12-cv-01688, ECF No. 23 Digitech Image Tech. LLC v. CDW LLC, No. 8:12-cv-01695, ECF No. 22. In addition, the retailer Defendants listed above are hereby ORDERED to communicate with Christopher Broderick as soon as practicable, but in no event later than April 5, 2013, to inform him whether each retailer

		will agree to be bound to this Courts Markman and invalidity rulings once the stay has been lifted in exchange for a stay of this entire litigation pending final resolution of every manufacturer action. Mr. Broderick shall then email the Courts courtroom deputy clerk, Sheila English Defendants. Defendant Sakars Motion to Transfer Venue in Digitech Image Technologies LLC v. Sakar International Inc., No. 8:12-cv-01673, ECF No. 13 (C.D. Cal. filed December 3, 2012) is hereby DENIED without prejudice. Defendants Sakar and Leica Camera Inc. may renew their motions to transfer after the Court issues a Markman order in this matter. Counter-Defendant Acacia Research Corporations Motion to Dismiss filed in Digitech Image Tech. LLC v. Newegg Inc., No. 8:12-cv-01688, ECF No. 30, is hereby taken under submission. An order will issue. In addition, the April 8, 2013 hearing on Defendant Leaf Imaging Ltd.s Motion to Dismiss filed in Digitech Image Tech. LLC v. Mamiya Digital Imaging Co., No. 8:12-cv-01688, ECF.No. 26, is hereby VACATED and no appearances are necessary. The Motion is taken under submission; an order will issue. Plaintiff is ORDERED to immediately serve a copy of this order on all Defendants who have not yet filed appearances in the cases (and who therefore have not received a copy through the CM/ECF system).Court Reporter: Katie Thibodeaux. (lc) Modified on 4/3/2013 (lc). Modified on 4/5/2013 (lc). (Entered: 04/03/2013)
04/02/2013	40	SCHEDULING AND CASE MANAGEMENT ORDER FOR CASES ASSIGNED TO Judge Otis D. Wright, II. (bp) (Entered: 04/03/2013)
04/04/2013	41	MINUTE ORDER IN CHAMBERS by Judge Otis D. Wright, II. The list of Digitech cases in the minutes of the scheduling conference held on April 1, 2013 39 , erroneously listed case numbers correlating to incorrect case names. The corrected list contained in this minute order shall hereby replace the list of Digitech cases on page 6 and page 7 of the April 1, 2013 Scheduling Conference Minute Order 39 . (cch) (Entered: 04/04/2013)
04/15/2013	42	JOINT BRIEF filed by plaintiff Digitech Image Technologies LLC. *re ESI Order and Protective Order* (Attachments: # 1 Exhibit 1 (proposed Stipulated ESI Order), # 2 Exhibit 2 (Plt proposed Protective Order), # 3 Exhibit 3 (Defs proposed Protective Order), # 4 Exhibit 4 (email), # 5 Exhibit 5 (email))(Edmonds, John) (Entered: 04/15/2013)
04/29/2013	43	TRANSCRIPT for proceedings held on 04-01-2013 1:38 p.m.. Court Reporter/Electronic Court Recorder: KATIE E. THIBODEAUX, CSR 9858, phone number (213) 894-8676. Transcript may be viewed at the court public terminal or purchased through the Court Reporter/Electronic Court Recorder before the deadline for Release of Transcript Restriction. After that date it may be obtained through PACER. Notice of Intent to Redact due within 7 days of this date. Redaction Request due 5/20/2013. Redacted Transcript Deadline set for 5/30/2013. Release of Transcript Restriction set for 7/28/2013. (Duvall, Richard) (Entered: 04/29/2013)
04/29/2013	44	NOTICE OF FILING TRANSCRIPT filed for proceedings 04-01-2013 1:38 p.m. re Transcript 43 THERE IS NO PDF DOCUMENT ASSOCIATED WITH THIS ENTRY.(Duvall, Richard) TEXT ONLY ENTRY (Entered: 04/29/2013)

05/20/2013	45	STIPULATION for Extension of Time to File Digitechs Local P.R. 3.1 & 3.2 Disclosure of Asserted Claims and Infringement Contentions and Document Production filed by Plaintiff Digitech Image Technologies LLC. (Attachments: # 1 Proposed Order)(Edmonds, John) Modified on 5/21/2013 (lc). (STRICKEN PER 5/21/13) (Entered: 05/20/2013)
05/21/2013		DOCUMENT number 46, Minutes deleted for the following reason: No Notice of Electronic Filing created. Document will be re-docketed.(cbr) (Entered: 05/21/2013)
05/21/2013	46	MINUTE ORDER IN CHAMBERS by Judge Otis D. Wright, II:The Court has received Digitech and the LG Defendants stipulation to continue Digitechsdeadline to disclose its asserted claims and infringement contentions and to produce documents. But Digitech filed this stipulation under the lead case, Digitech Image Technologies LLC v. Electronics for Imaging, Inc., No. 8:12-cv-01324-ODW(MRWx). As the Court explained inthe scheduling conference minutes, documents intended to apply only to particular cases are to be filed only with the individual case to which it applies. (Scheduling Conference Minutes, ECF No. 39, at 2.) Because the stipulation currently before the Court applies only to the individual Digitech case against the LG Defendants, the Court hereby STRIKES the parties stipulation 45 . (lc) (Entered: 05/21/2013)
05/22/2013	47	STIPULATED ELECTRONICALLY STORED INFORMATION ORDER by Judge Otis D. Wright, II (lc). Modified on 5/23/2013. (lc). (Entered: 05/23/2013)
05/22/2013	48	PROTECTIVE ORDER by Judge Otis D. Wright, II (lc) (Entered: 05/23/2013)
05/29/2013	49	NOTICE of Appearance filed by attorney Mark L Blake on behalf of Defendant Electronics For Imaging Inc (Blake, Mark) (Entered: 05/29/2013)
06/03/2013	50	ORDER by Judge Otis D. Wright, II, re Stipulation 45 that Plaintiffs Local P.R. 3.1 & 3.2 Disclosure of Asserted Claims and Infringement Contentions and Document Production shall be extended from June 3, 2013 to June 10, 2013. (lc) (Entered: 06/03/2013)
06/07/2013	51	APPLICATION of Joshua B. Long to Withdraw as Attorney *as counsel for Plaintiff* filed by plaintiff Digitech Image Technologies LLC. Application set for hearing on 7/8/2013 at 01:30 PM before Judge Otis D. Wright II. (Attachments: # 1 Proposed Order)(Edmonds, John) (Entered: 06/07/2013)
06/07/2013	52	ORDER GRANTING UNOPPOSED APPLICATION OF JOSHUA B. LONG TO WITHDRAW ASCOUNSEL FOR PLAINTIFF 51 by Judge Otis D. Wright, II (lc) (Entered: 06/07/2013)
06/13/2013	53	NOTICE OF MOTION AND MOTION for Leave to Amend its Patent L.R. 3.1 & 3.2 Disclosure of Asserted Claims and Infringement Contentions on Defendant Electronics For Imaging, Inc *(Unopposed)* filed by plaintiff Digitech Image Technologies LLC. (Attachments: # 1 Proposed Order)(Edmonds, John) (Entered: 06/13/2013)
06/13/2013	54	ORDER by Judge Otis D. Wright, II: granting 53 Plaintiffs Unopposed Motion for

		Leave to Amend Its Patent L.R. 3.1 & 3.2 Disclosure of Asserted Claims and Infringement Contentions to Defendant Electronics For Imaging, Inc. on or before 6/14/13. (lc) (Entered: 06/14/2013)
06/14/2013	55	Notice of Appearance or Withdrawal of Counsel: for attorney Bruce D Kuyper counsel for Defendant Pentax Ricoh Imaging Co Ltd. Bruce D. Kuyper is no longer attorney of record for the aforementioned party in this case for the reason indicated in the G-123 Notice. Filed by defendant Pentax Ricoh Imaging Co. Ltd.. (Kuyper, Bruce) (Entered: 06/14/2013)
06/14/2013	56	Notice of Appearance or Withdrawal of Counsel: for attorney Bruce D Kuyper counsel for Defendant Pentax Ricoh Imaging Co Ltd. Richard de Bodo is no longer attorney of record for the aforementioned party in this case for the reason indicated in the G-123 Notice. Filed by defendant Pentax Ricoh Imaging Co. Ltd.. (Kuyper, Bruce) (Entered: 06/14/2013)
06/17/2013	57	REQUEST to Substitute attorney Joshua M. Masur in place of attorney Jon W. Gurka, Reza Mirzaie, Damien Howard filed by Defendant General Imaging Company. (Attachments: # 1 Proposed Order)(Masur, Joshua) Modified on 6/26/2013 (lc). (STRICKEN PER 6/26/13 ORDER). (Entered: 06/17/2013)
06/17/2013	58	REQUEST for Leave to File Motion for Summary Judgment filed by Defendants Canon Inc., Fujifilm Corporation, Konica Minolta Business Solutions USA Inc, Nikon Corporation, Olympus Corporation, Olympus Imaging America Inc., Panasonic Corporation, Panasonic Corporation of North America, Pentax Ricoh Imaging Co Ltd, Sigma Corporation, Sigma Corporation of America. (Broderick, Christopher) (Entered: 06/17/2013)
06/24/2013	59	Opposition re: REQUEST for Leave to File Motion for Summary Judgment 58 filed by Plaintiff Digitech Image Technologies LLC. (Edmonds, John) (Entered: 06/25/2013)
06/25/2013	60	Notice of Electronic Filing re Objection/Opposition (Motion related) 59 bounced due to Attorney Jason Blake Cunningham no longer works at the firm.. The primary e-mail address associated with the attorney record has been deleted. Pursuant to Local Rules it is the attorneys obligation to maintain all personal contact information including e-mail address in the CM/ECF system. THERE IS NO PDF DOCUMENT ASSOCIATED WITH THIS ENTRY.(vho) TEXT ONLY ENTRY (Entered: 06/25/2013)
06/25/2013	61	NOTICE of Appearance filed by attorney Michelle Stover on behalf of Defendant Electronics For Imaging Inc (Stover, Michelle) (Entered: 06/25/2013)
06/26/2013	62	ORDER by Judge Otis D. Wright, II: the following document(s) be STRICKEN for failure to comply with the Local Rules, General Order and/or the Courts Case Management Order: REQUEST to Substitute attorney Joshua M. Masur in place of attorney Jon W. Gurka, Reza Mirzaie, Damien Howard 57 , for the following reasons: : Document attached was docketed in correct case: SA CV 12-1680. Counsel e-filed on incorrect case number. Therefore the court strikes the document 57 . (lc) (Entered: 06/26/2013)

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06/26/2013	63	ORDER GRANTING REQUEST FOR LEAVE TO FILE MOTION FOR SUMMARY JUDGMENT 58 by Judge Otis D. Wright, II. Defendants must file their motion and supporting documents by Wednesday, July 3, 2013, noticing a hearing for July 29, 2013, at 1:30 p.m. Plaintiff must file its opposition by Wednesday, July 10, 2013, and Defendants must their reply brief (if desired) by Wednesday, July 17, 2013. The Court does not believe that a full-scale claim construction is necessary at this stage, and the parties are requested to act accordingly. The page limits remain 25 for opening and opposition briefs, and 12 for the reply brief. Additionally, the Court will not alter the current case schedule because of this motion for summary judgment: the case schedule remains undisturbed, including the Markman hearing set for November 11, 2013. (cch) (Entered: 06/26/2013)
07/03/2013	64	NOTICE OF MOTION AND MOTION for Summary Judgment as to Invalidity filed by Defendants Fujifilm Corporation, Konica Minolta Business Solutions USA Inc, Pentax Ricoh Imaging Co Ltd, Sigma Corporation, Sigma Corporation of America. Motion set for hearing on 7/29/2013 at 01:30 PM before Judge Otis D. Wright II. (Attachments: # 1 Memorandum, # 2 Stmnt of Uncontroverted Facts and Conclusions of Law, # 3 Declaration A. Yen, # 4 Exhibit A, # 5 Exhibit B, # 6 Exhibit C, # 7 Exhibit D, # 8 Proposed Order)(Broderick, Christopher) (Entered: 07/03/2013)
07/05/2013	65	NOTICE OF MOTION AND Joint MOTION to Dismiss DEFENDANTS ACER AMERICA CORPORATION AND ACER INC. filed by plaintiff Digitech Image Technologies LLC. (Attachments: # 1 Proposed Order)(Edmonds, John) (Entered: 07/05/2013)
07/05/2013	66	ORDER GRANTING JOINT MOTION TO DISMISS DEFENDANTS ACER AMERICA CORPORATION AND ACER INC. 65 . All attorneys fees, costs of court and expenses shall be borne by each party incurring the same by Judge Otis D. Wright, II (lc) Modified on 7/5/2013 (lc). (Entered: 07/05/2013)
07/08/2013	67	ORDER GRANTING JOINT MOTION TO DISMISS DEFENDANTS SONY CORPORATION, SONY CORPORATION OF AMERICA AND SONY ELECTRONICS INC with prejudice; Each party bear own costs and expenses by Judge Otis D. Wright, II (lc) (Entered: 07/08/2013)
07/08/2013	68	NOTICE OF MOTION AND MOTION to Strike Plaintiff's Infringement Contentions *and Memorandum of Points and Authorities* filed by Defendant Electronics For Imaging Inc. Motion set for hearing on 8/5/2013 at 01:30 PM before Judge Otis D. Wright II. (Attachments: # 1 Declaration of Mark L. Blake, # 2 Exhibit 1-5, # 3 Exhibit 6-8, # 4 Exhibit 9-11, # 5 Exhibit 12, # 6 Exhibit 13-16, # 7 Exhibit 17-21, # 8 Exhibit 22-27, # 9 Proposed Order ISO Motion)(Blake, Mark) (Entered: 07/08/2013)
07/08/2013	69	NOTICE filed by Defendant Electronics For Imaging Inc. *of Manual Filing* (Blake, Mark) (Entered: 07/08/2013)
07/08/2013	70	*Application to File Under Seal - Exhibit 26 to the Declaration of Mark L. Blake* re: MOTION to Strike Plaintiff's Infringement Contentions *and Memorandum of Points*

		and Authorities 68 (Attachments: # 1 Proposed Order re Application)(Blake, Mark) (Entered: 07/08/2013)
07/09/2013	75	SEALED DOCUMENT- Defendant Electronics For Imaging Inc's Exhibit 26 to the Declaration of Mark L. Blake. (Attachments: Part 2, Part 3)(mat) (Entered: 07/11/2013)
07/10/2013	71	ORDER GRANTING 70 DEFENDANT ELECTRONICS FOR IMAGING, INC.S APPLICATION PURSUANTTO LOCAL RULE 79-5.1 TO FILE UNDER SEAL: EXHIBIT 26 TO THE DECLARATION OF MARK L.BLAKE by Judge Otis D. Wright, II (lc) (Entered: 07/10/2013)
07/10/2013	72	REQUEST to Substitute attorney Joshua M. Masur in place of attorney Jon W. Gurka, Reza Mirzaie, Damien Howard filed by Defendant General Imaging Company. (Attachments: # 1 Proposed Order)(Masur, Joshua) (Entered: 07/10/2013)
07/10/2013	73	OPPOSITION to MOTION for Summary Judgment as to Invalidity 64 filed by Plaintiff Digitech Image Technologies LLC. (Attachments: # 1 Declaration Cannizzo Declaration, # 2 Declaration Edmonds Declaration, # 3 Exhibit 1, # 4 Exhibit 2 (part 1), # 5 Exhibit 2 (part 2), # 6 Supplement Statement of Disputed Facts)(Edmonds, John) (Entered: 07/10/2013)
07/10/2013	74	ORDER by Judge Otis D. Wright, II: granting 72 Request to Substitute Attorney Joshua M. Masur in place and instead of Jon W. Gurka on behalf of defendant General Imaging Company. (lc) (Entered: 07/11/2013)
07/12/2013	76	Notice of Appearance or Withdrawal of Counsel: for attorney Geoffrey K Gavin counsel for Defendant Motorola Mobility LLC. Geoffrey K. Gavin will no longer receive service of documents from the Clerks Office for the reason indicated in the G-123 Notice.Geoffrey K. Gavin is no longer attorney of record for the aforementioned party in this case for the reason indicated in the G-123 Notice. Filed by Defendant Motorola Mobility LLC. (Gavin, Geoffrey) (Entered: 07/12/2013)
07/16/2013	77	Opposition Opposition re: MOTION to Strike Plaintiff's Infringement Contentions *and Memorandum of Points and Authorities* 68 filed by Plaintiff Digitech Image Technologies LLC. (Attachments: # 1 Exhibit 1, # 2 Declaration, # 3 Declaration, # 4 Declaration)(Edmonds, John) (Entered: 07/16/2013)
07/16/2013	78	ORDER DISMISSING CASE by Judge Otis D. Wright, II. IT IS ORDERED that Plaintiffs claims for relief against Best Buy and Best Buys counterclaims for relief against Plaintiff are dismissed with prejudice. IT IS FURTHER ORDERED that all attorneys fees, costs of court and expenses shall be borne by each party incurring the same. Case Terminated. Made JS-6., (Made JS-6. Case Terminated.) (cch) (Entered: 07/17/2013)
07/17/2013	79	NOTICE OF CLERICAL ERROR Re: Order Dismissing Case 78 Terminated Case. The Order Dismissing Case 78 was erroneously docketed in this case. This order should be docketed only in the case 8:12-cv-01669-ODW (MRWx). Due to the clerical error, the case was erroneously terminated; however, the error has been corrected and the case has been re-opened. (cch) (Entered: 07/17/2013)

07/17/2013	80	RESPONSE IN SUPPORT of MOTION for Summary Judgment as to Invalidity 64 filed by Defendants Fujifilm Corporation, Konica Minolta Business Solutions USA Inc, Pentax Ricoh Imaging Co Ltd, Sigma Corporation. (Attachments: # 1 RESPONSE TO DIGITECHS STATEMENT OF GENUINE ISSUES OF MATERIAL FACT, # 2 Declaration of Andrew Yen, # 3 Exhibit 1, # 4 Exhibit 2)(Broderick, Christopher) (Entered: 07/17/2013)
07/19/2013	81	MINUTES (IN CHAMBERS) by Judge Otis D. Wright, II: Hearing on MOTION for SummaryJudgment 64 , scheduled for July 29, 2013 at 1:30 P.M., is hereby VACATED and taken off calendar. No appearances are necessary. The matter stands submitted, and will be decided upon without oral argument. An order will issue. (lc) Modified on 7/19/2013 (lc). (Entered: 07/19/2013)
07/22/2013	82	REPLY in support of MOTION to Strike Plaintiff's Infringement Contentions *and Memorandum of Points and Authorities* 68 filed by Defendant Electronics For Imaging Inc. (Attachments: # 1 Declaration (Reply) of Mark L. Blake, # 2 Exhibit 28-33 to Reply Declaration of Mark L. Blake, # 3 Exhibit 34-35 to Reply Declaration of Mark L. Blake, # 4 Exhibit 36-38 to Reply Declaration of Mark L. Blake)(Blake, Mark) (Entered: 07/22/2013)
07/22/2013	83	APPLICATION for Order for Filing Exhibits Under Seal filed by Defendant Electronics For Imaging Inc. (Attachments: # 1 Proposed Order to File Under Seal)(Blake, Mark) (Entered: 07/22/2013)
07/23/2013	84	ORDER GRANTING DEFENDANT ELECTRONICS FOR IMAGING, INC.S APPLICATIONPURSUANT TO L.R. 79-5.1 TO FILE UNDER SEAL: EXHIBITS 31 and 32 TO THE DECLARATION OF MARK L. BLAKE IN SUPPORT OF EFI REPLY TO ITS MOTION TOSTRIKE PLAINTIFFS INFRINGEMENT CONTENTIONS 83 by Judge Otis D. Wright, II (lc) (Entered: 07/23/2013)
07/24/2013	85	MINUTES (IN CHAMBERS) by Judge Otis D. Wright, II: The hearing on the MOTION to Strike 68 scheduled for August 5, 2013 at 1:30 P.M., is hereby VACATED and taken off calendar. No appearances are necessary. The matter stands submitted, and will be decided upon without oral argument. An order will issue. (lc) Modified on 7/24/2013 (lc). (Entered: 07/24/2013)
07/26/2013	86	EX PARTE APPLICATION to Strike New Evidence and Arguments made by Electronics for Imaging, Inc. re Reply (Motion related), 82 filed by plaintiff Digitech Image Technologies LLC. (Attachments: # 1 Memorandum, # 2 Declaration, # 3 Exhibit 1, # 4 Exhibit 2, # 5 Proposed Order, # 6 Proposed Order)(Edmonds, John) (Entered: 07/26/2013)
07/28/2013	87	OPPOSITION to EX PARTE APPLICATION to Strike New Evidence and Arguments made by Electronics for Imaging, Inc. re Reply (Motion related), 82 86 filed by Defendant Electronics For Imaging Inc. (Attachments: # 1 Declaration of Frank P. Cote, # 2 Exhibit 1, # 3 Exhibit 2)(Cote, Frank) (Entered: 07/28/2013)
07/31/2013	88	ORDER GRANTING MOTION FOR SUMMARY JUDGMENT 64 by Judge Otis

		D. Wright, II. (lc). Modified on 7/31/2013.(lc). (Entered: 07/31/2013)
07/31/2013	89	ORDER by Judge Otis D. Wright, II: In view of the Courts July 31, 2013 Order Granting Summary Judgment, the Court hereby DENIES the following pending motions: Electronics For Imaging, Inc.s Motion to Strike Plaintiffs Infringement Contentions is DENIED AS MOOT (No. 8:12-cv-1324-ODW(MRWx), 68 ; Digitech Image Technologies LLCs Ex Parte Application is DENIED ASMOOT (No. 8:12-cv-1324-ODW(MRWx), 86 ; Ricoh Co., Ltd. and Ricoh Americans Corp.s Motion for Leave to File Third Party Complaint is DENIED (No. 8:12-cv-1689-ODW(MRWx), ECF No. 35); Xerox Corp.s Motion for Leave to File Third Party Complaint is DENIED (No. 8:12-cv-1693-ODW(MRWx), ECF No. 27);Konica Minolta Business Solutions U.S.A., Inc.s Motion for Leave to FileThird Party Complaint is DENIED (No. 8:12-cv-1694-ODW(MRWx), ECF No. 35).Further, in an abundance of caution, the Court hereby ORDERS all parties to file a joint status report by August 7, 2013. This report should be filed only in the lead case (No. 8:12-cv-1324-ODW(MRWx)), and must briefly state reasons why, in light of the Courts findings that claims 16, 9, 1015, and 2631 are invalid under 35 U.S.C. 101, the Court should not enter final judgment in favor of Defendants. For instance, though the Court believes this is not the case, it is conceivable that Digitech has asserted claims 78, 1625, or 3233 against one or more Defendants. There may also be other reasons unknown to the Court why it should not enter final judgment. (lc). Modified on 7/31/2013. (lc). (Entered: 07/31/2013)
08/05/2013	90	STATUS REPORT *Joint Status Report* filed by Plaintiff Digitech Image Technologies LLC. (Edmonds, John) (Entered: 08/05/2013)
08/05/2013	91	Joint STIPULATION to Continue Compliance with Patent Local Rule 4-2 from August 5, 2013 to Cancelled filed by plaintiff Digitech Image Technologies LLC. (Attachments: # 1 Proposed Order)(Edmonds, John) (Entered: 08/05/2013)
08/06/2013	92	ORDER GRANTING STIPULATED MOTION FOR CANCELATION OF PATENT RULE 4-2 DEADLINE 91 by Judge Otis D. Wright, II (lc) (Entered: 08/06/2013)
08/06/2013	93	JUDGMENT by Judge Otis D. Wright, II :In light of the Courts Order Granting Motion for Summary Judgment (Digitech Image Techs., LLC v. Elecs. for Imaging, Inc., No. 8:12-cv-1324-ODW(MRWx) (C.D. Cal. July 31, 2013) 88 and the parties representations in their August 5, 2013 Joint Status Report (Id. 90), IT IS HEREBY ORDERED: 1. Plaintiff Digitech Image Technologies, LLC shall take nothing; 2. Judgment for each of the Defendants in this and the related cases. (MD JS-6, Case Terminated). (lc) (Entered: 08/07/2013)
08/07/2013	94	REPORT ON THE DETERMINATION OF AN ACTION Regarding a Patent or Trademark. (Closing) (Attachments: # 1 judgment) (lc) (Entered: 08/07/2013)
08/20/2013	95	NOTICE OF MOTION AND MOTION for Costs against All Plaintiffs RE: Judgment, 93 filed by Defendant Electronics For Imaging Inc. Motion set for hearing on 9/5/2013 at 09:00 AM before Clerk of Court. (Attachments: # 1 Exhibit A, # 2 Exhibit B)(Blake, Mark) (Entered: 08/20/2013)

08/20/2013	96	NOTICE OF MOTION AND MOTION for Costs against Asus Computer International, Asustek Computer IncRE: Judgment, 93 filed by Defendant Asus Computer International, Asustek Computer Inc. Motion set for hearing on 9/5/2013 at 09:00 AM before Clerk of Court. (Attachments: # 1 Exhibit A, # 2 Exhibit B)(Masur, Joshua) (Entered: 08/20/2013)
08/21/2013	97	NOTICE OF MOTION AND MOTION for Costs against All Plaintiffs RE: Judgment, 93 filed by Defendant General Imaging Company. Motion set for hearing on 9/5/2013 at 09:00 AM before Clerk of Court. (Attachments: # 1 Exhibit A, # 2 Exhibit B)(Gu, Zhuanjia) (Entered: 08/21/2013)
08/28/2013	98	NOTICE OF APPEAL to the Federal Circuit filed by Plaintiff Digitech Image Technologies LLC. Appeal of Order on Motion for Summary Judgment 88 , Judgment, 93 (Appeal fee of $455 receipt number 0973-12615642 paid.) (Attachments: # 1 Exhibit Exhibit 1 - Order Granting Summary Judgment, # 2 Exhibit Exhibit 2 - Joint Status Report, # 3 Exhibit Exhibit 3 - Scheduling Conference Minutes)(Edmonds, John) (Entered: 08/28/2013)
08/28/2013		TRANSMISSION of the Notice of Appeal, Docket Sheet, Judgment and or order e-mailed to the US Court of Appeals for the Federal Circuit re: Notice of Appeal to Federal Circuit Court of Appeals, 98 (car) (Entered: 08/28/2013)
08/29/2013	99	OPPOSITION to MOTION for Costs against All Plaintiffs RE: Judgment, 93 95 filed by Plaintiff Digitech Image Technologies LLC. (Edmonds, John) (Entered: 08/29/2013)
08/29/2013	100	OPPOSITION to MOTION for Costs against Asus Computer International, Asustek Computer IncRE: Judgment, 93 96 filed by Plaintiff Digitech Image Technologies LLC. (Edmonds, John) (Entered: 08/29/2013)
08/29/2013	101	OPPOSITION to MOTION for Costs against All Plaintiffs RE: Judgment, 93 97 *(General Imaging Company)* filed by Plaintiff Digitech Image Technologies LLC. (Edmonds, John) (Entered: 08/29/2013)
08/30/2013	102	REPLY filed by Defendant Electronics For Imaging Inc to MOTION for Costs against All Plaintiffs RE: Judgment, 93 95 (Blake, Mark) (Entered: 08/30/2013)
09/02/2013	103	OPPOSITION to MOTION for Costs against All Plaintiffs RE: Judgment, 93 95 *Sur-Reply in Support of Objections* filed by Plaintiff Digitech Image Technologies LLC. (Edmonds, John) (Entered: 09/02/2013)
09/02/2013	104	REPLY Support MOTION for Costs against Asus Computer International, Asustek Computer IncRE: Judgment, 93 96 filed by Defendants Asus Computer International, Asustek Computer Inc. (Gu, Zhuanjia) (Entered: 09/02/2013)
09/02/2013	105	REPLY Support MOTION for Costs against All Plaintiffs RE: Judgment, 93 97 filed by Defendant General Imaging Company. (Gu, Zhuanjia) (Entered: 09/02/2013)
09/03/2013	106	OPPOSITION to MOTION for Costs against Asus Computer International, Asustek Computer IncRE: Judgment, 93 96 *Sur-Reply in Opposition* filed by Plaintiff Digitech

		Image Technologies LLC. (Attachments: # 1 Exhibit A-Sur-Reply in Opposition to Electronics for Imaging's Bill of Costs)(Edmonds, John) (Entered: 09/03/2013)
09/03/2013	107	OPPOSITION to MOTION for Costs against All Plaintiffs RE: Judgment, 93 97 *Sur-Reply in Support of Opposition* filed by Plaintiff Digitech Image Technologies LLC. (Attachments: # 1 Exhibit A-Sur-Reply in Opposition to Electronics for Imaging's Bill of Costs)(Edmonds, John) (Entered: 09/03/2013)
09/04/2013	108	NOTIFICATION by Federal Circuit Court of Appellate Docket Number 13-1600, regarding Notice of Appeal to Federal Circuit Court of Appeals, 98 as to Plaintiff Digitech Image Technologies LLC. (car) (Entered: 09/04/2013)

US006128415A

United States Patent [19]

Hultgren, III et al.

[11] **Patent Number: 6,128,415**

[45] **Date of Patent: *Oct. 3, 2000**

[54] **DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM**

[75] Inventors: **Bror O. Hultgren, III**, Ipswich; **F. Richard Cottrell**, Easton; **Jay E. Thornton**, Watertown, all of Mass.

[73] Assignee: **Polaroid Corporation**, Cambridge, Mass.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/709,487**

[22] Filed: **Sep. 6, 1996**

[51] **Int. Cl.**[7] **G06K 9/00**; G06K 9/36; G03F 3/08; G03F 3/10

[52] **U.S. Cl.** **382/276**; 382/162; 382/167; 382/266; 345/431; 358/518; 358/527

[58] **Field of Search** 382/167, 276, 382/266, 239, 162; 358/518, 527, 520; 345/418, 431

[56] **References Cited**

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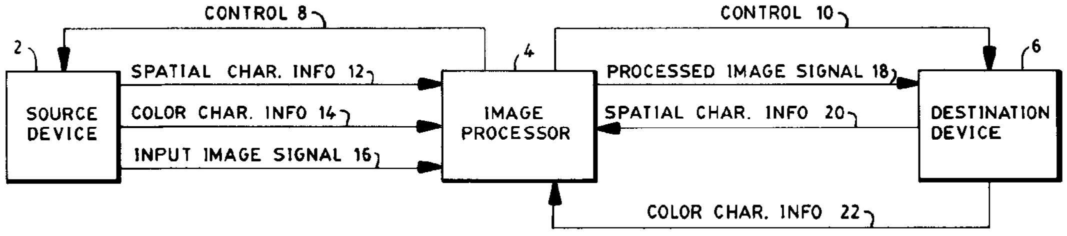
Primary Examiner—Andrew J. Johns
Assistant Examiner—Daniel G. Mariam
Attorney, Agent, or Firm—Robert J. Decker

[57] **ABSTRACT**

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

33 Claims, 3 Drawing Sheets



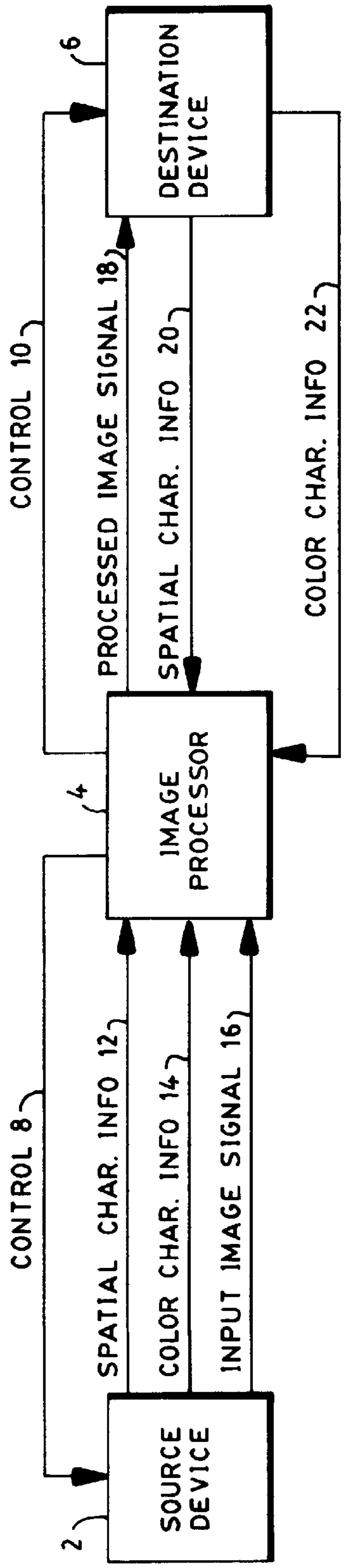

DESTINATION DEVICE
6
CONTROL 10
PROCESSED IMAGE SIGNAL 18
SPATIAL CHAR. INFO 20
COLOR CHAR. INFO 22
IMAGE PROCESSOR
4
CONTROL 8
SPATIAL CHAR. INFO 12
COLOR CHAR. INFO 14
INPUT IMAGE SIGNAL 16
SOURCE DEVICE
2

FIG. 1

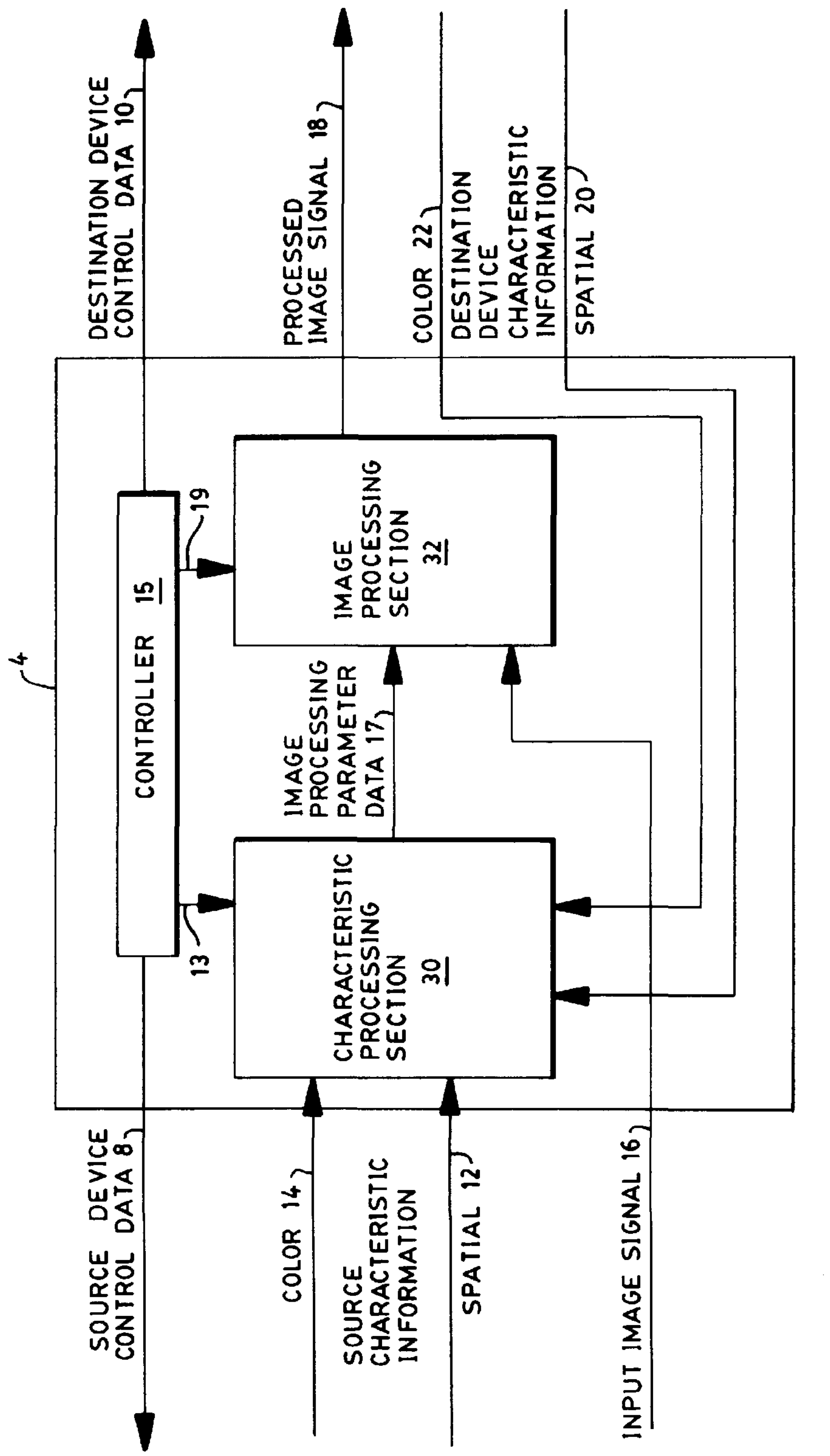

DESTINATION DEVICE CONTROL DATA 10
PROCESSED IMAGE SIGNAL 18
COLOR 22
DESTINATION DEVICE CHARACTERISTIC INFORMATION
SPATIAL 20
4
CONTROLLER 15
19
13
IMAGE PROCESSING SECTION 32
IMAGE PROCESSING PARAMETER DATA 17
CHARACTERISTIC PROCESSING SECTION 30
SOURCE DEVICE CONTROL DATA 8
COLOR 14
SOURCE CHARACTERISTIC INFORMATION
SPATIAL 12
INPUT IMAGE SIGNAL 16

FIG. 2

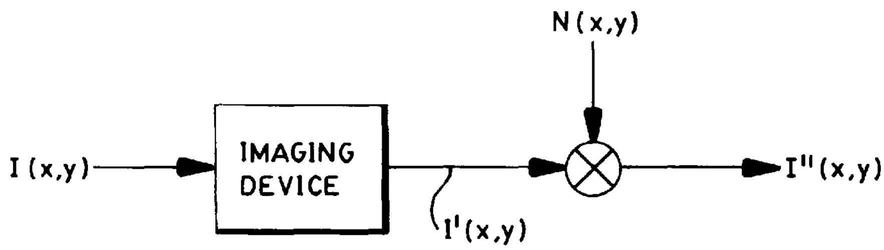

N(x,y)
I(x,y)
IMAGING DEVICE
I'(x,y)
I''(x,y)

FIG. 3

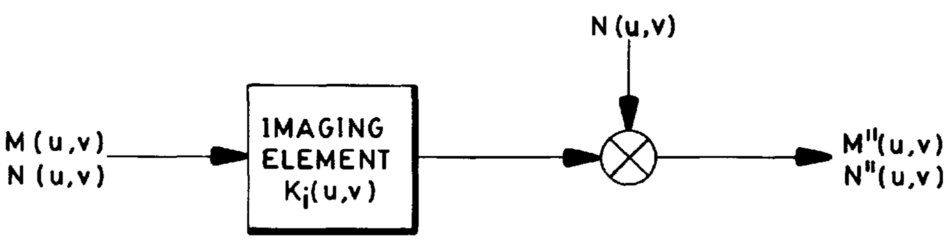

N(u,v)
M(u,v)
N(u,v)
IMAGING ELEMENT
K_i(u,v)
M''(u,v)
N''(u,v)

FIG. 4

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed generally towards digital image processing and more specifically towards generation and use of an improved device profile for describing both spatial and color properties of a device within an image processing system, so that a processed image can be more accurately captured, transformed or rendered.

2. Description of the Prior Art

Digital image processing involves electronically capturing an image of a scene, altering the captured image in some desired fashion and passing the altered image to an output device. An upstream element of a digital image processing system can be thought of as a source device, whereas a downstream element can be thought of as a destination device. For instance, a simple image processing system could include an acquisition device such as a digital camera, camcorder, scanner, CCD, etc., a color processor for processing the colors of the image, and an output device, such as a printer, monitor, computer memory, etc. When considering a communication between the acquisition device and the color processor, the acquisition device is deemed as the source device whereas the color processor is deemed as the destination device. When considering a communication between the color processor and the output device, the color processor is deemed as the source device whereas the output device is deemed as the destination device.

All imaging devices, either image acquisition or image display, will impose distortions of the color and spatial components of the image data.

Historically, industry has chosen to correct these distortions with device dependent solutions. It is common practice in the industry that an integral part of the design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices to ameliorate these distortions. For example, electronic peaking filters are often employed in video capture devices to correct for the blurring effects of anti-aliasing filters and amplifier frequency response. Electronic imaging devices are commonly designed to function with specific upstream (in the case of display devices) or downstream (in the case of image sources) devices to provide quality images. For example, image capture devices commonly transform the image digits to compensate ('gamma corrected') for the CRT volts-luminance characteristics of CRT displays. Such design considerations provide a device dependent model for that specific implementation of an image processing system, but do not provide the same degree of image quality when substituting an alternative device.

Recently, device independent paradigms for the characterization of color information in an image processing system have been developed and are being implemented: Color Sync, developed by Apple Computer and KCMS, developed by Eastman Kodak Co., are examples of systems or components supporting a device independent color paradigm. This paradigm is based upon a characterization of the image pixel data (digits) in a device independent color space—e.g. CIE L*a*b* or CIE XYZ, and the use of a Color Management System. The characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device. However, the spatial characteristics of digital imaging devices are still modified in the context of the device dependent model described above.

In order to improve processing flexibility and versatility, it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system. This paradigm will capture the spatial characterization of the imaging device in a tagged file format, referred to as a device spatial profile.

SUMMARY OF THE INVENTION

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured chromatic response and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned aspects and other features of the invention are described in detail in conjunction with the accompanying drawings in which the same reference numerals are used throughout for denoting corresponding elements and wherein:

FIG. **1** is a block diagram of a basic digital image processing system according to the invention;

FIG. **2** is a detailed block diagram of the image processor of FIG. **1**;

FIG. **3** is a model of characteristic functions sufficient to reconstruct signal and noise power distributions for linear, stationary image systems having additive noise; and

FIG. **4** is a model of the effect of an image processing element upon an image.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A simplified version of a digital image processing system is shown in the block diagram of FIG. **1**. The acquisition device **2**, for instance a digital camera, acquires an image which is represented as the input image signal **16**. The image processor **4** receives the input image signal **16**, acquisition device spatial characteristic information **12** and acquisition device color characteristic information **14** in response to a control signal **8**. The image processor **4** also receives output device spatial characteristic information **20** and output device color characteristic information **22** from the output device **6** in response to a control signal **10**. After processing the input image signal **16** in accordance with all the signals received by the processor **4**, the image processor **4** sends the processed image signal **18** to output device **6**, for instance a printer which produces a hardcopy of the processed image.

An image includes both spatial and chromatic information. The spatial content of an image can be described by its signal and noise power distributions. An image's signal or noise power distribution will be transformed by a device but

does not give an unique description of the device because the distributions are image specific and they will be determined by the result of all preceding image transformations. However for one class of imaging devices namely linear, stationary imaging systems with additive noise, characteristic functions sufficient to reconstruct the signal and noise power distributions can be constructed. In practice many systems not conforming to these conditions can be approximated as linear, stationary imaging systems with additive noise having sufficient accuracy to enable the prediction of perceived image quality if not full image reconstruction.

Spatial characteristics of the elements of an image processing system or platform can be represented in at least two forms. In a first form, a characteristic processing section **30** of the image processing platform contains spatial characteristic functions describing added noise and image signal transform characteristics of the source and destination devices. In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, the characteristic processing section **30** contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. patent application Ser. No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation. This patent application is hereby incorporated in its entirety to provide supplemental background information which is non-essential but helpful in appreciating the applications of the present invention.

FIG. **2** is a detailed diagram of the image processor **4** of FIG. **1**. The image processor **4** includes a controller **15**, a characteristic processing section **30** and an image processing section **32**. The characteristic processing section **30** produces image processing data **17** in response to color source characteristic information **14**, spatial source characteristic information **12**, color destination device characteristic information **22**, spatial destination device characteristic information **20**, and a first control signal **13** from the controller **15**. In turn, the image processing section **32** produces a processed image signal **18** in response to the image processing parameter data **17**, an input image signal **16** and a second control signal **19** from the controller **4**. The controller **15** also generates both source device control data **8** and destination device control data **10**.

If I(x,y) represents the intensity distribution over the spatial coordinates (x,y) of the image and I(u,v) represents the corresponding frequency domain representation of the image constructed from the Fourier transform of I(x,y), then the transformation of the image by a linear, stationary imaging element can be represented as shown in FIG. **3**. In the spatial domain the transformation is described by a Linear function S(g(x,y)):

$$I'(x,y)=S(I(x,y)) \tag{1}$$

$$I''(x,y)=S(I(x,y)+N(x,y)) \tag{2}$$

and in the Fourier (spatial frequency) domain by the Fourier Transform S(G(u,u)) of S(g(x,y)):

$$I(u,v)=S(I(u,v)) \tag{3}$$

$$I''(u,v)=S(I(u,v)+N(u,v)) \tag{4}$$

where N(x,y) and its corresponding Fourier Transform N(u,v) represents the additive noise.

For a linear, stationary imaging system, the transfer function S(g(x,y)) is given by

$$S(g(x,y))=s(x,y)\otimes g(x,y) \tag{5}$$

where $\otimes$ signifies convolution. S(G(u,v) is given by:

$$S(G(u,v))=S(u,v)*G(u,v) \tag{6}$$

where * signifies point multiplication.

In principle S(u,v) can be computed from the ratio of the output/input signal power distributions. In practice, S(u,v) is determined from fourier analysis of images of step input images via edge gradient analysis, or point or line images via point or line spread analysis. The transfer function is commonly called the Modulation Transfer Function (MTF).

If the input image is an uniform image $I(x,y)=I_0$, Fourier analysis of the output image will yield the Wiener Noise Power Spectrum N(u,v) which is the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

As stated previously, most real systems violate the criteria for being linear and stationary; and while introducing additive noise, that noise is often gray level dependent. This type of noise is referred to as non-linear, non-stationary, gray level dependent additive noise.

If a number of uniform field images, each described by a constant intensity I_y (where Y represents the luminance level) are processed by a device, Fourier analysis of the output images will yield Wiener Noise Power Spectra $N_y(u,v)$. The set of gray level dependent Wiener Noise Power Spectra represents the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

For non-linear image transforms a set of signal level dependent MTFs could, in principle, be generated to represent the characteristic functions describing the signal transform in the imaging device. In practice a single characteristic function can be generated from an ensemble average of MTFs or a small signal approximation. In general all of these characteristic functions are two-dimensional functions which are represented as M(u,v).

For non-stationary image transforms the image signal transform characteristic function can, in principle, be represented by a multi-dimensional function, M(x,y,u,v), generated from a local fourier analysis of the point spread function located at the position (x,y). In practice the characteristic function can be approximated by an ensemble average of the position dependent multi-dimensional function M(x,y,u,v).

$$M(u,v)=<M(x,y,u,v)>_{xy} \tag{7}$$

where the operation $<M(x,y,u,v)>_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y.

The processing of spatial characteristic functions in the image processing system of the preferred embodiment is model based. For a linear imaging system with additive noise, each image processing element is represented by a transfer function that is a model of the effect of that image processing element upon an image as shown in FIG. **4** and defined by equations (7) and (8) in the frequency domain.

$$M''(u,v)=Ki(u,v)*M(u,v) \tag{8}$$

$$N''(u,v)=Ki^2(u,v)*N(u,v)+Ni(u,v) \tag{9}$$

For non-linear imaging elements, the transfer function may be a more general representation of the characteristic func-

tions presented to the imaging element and evaluated in terms of a model of the imaging element.

Spatial characteristic functions are generated from fourier analysis of selected target images. Characteristic functions (a) may be scalar, one or two dimensional arrays for at least one of the device N channels, (b) are evaluated over the spatial frequency range 0 to the Nyquist frequency in equal frequency intervals, and (c) for source devices may be stated either in a proprietary processing space or in device independent space.

In the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format, as described in the ICC Profile Specification, version 3. 10b dated Oct. 21, 1995. The tagged format should include information as to which class the particular characteristic function belongs, i.e. Modulation Transfer Functions, Wiener Noise Power Spectra, or gray level dependent Wiener noise masks. The tagged format should also include information sufficient to identify both the relevant units of spatial frequency and the dimensionality of the characteristic functions. Propagation of characteristic functions is calculated within the context of the model based image processing system.

It is to be understood that the above described embodiments are merely illustrative of the present invention and represent a limited number of the possible specific embodiments that can provide applications of the principles of the invention. Numerous and varied other arrangements may be readily devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention as claimed.

What is claimed is:

1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.

2. The device profile of claim **1** wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

3. The device profile of claim **2**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

4. The device profile of claim **1**, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

5. The device profile of claim **1**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

6. The device profile of claim **5**, wherein said gray level dependent additive noise is spatially dependent.

7. The device profile of claim **1**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

8. The device profile of claim **7**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

9. The device profile of claim **1** wherein, for said device, the second data is generated through use of spatial stimuli and device response characteristic functions.

10. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;

generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and

combining said first and second data into the device profile.

11. The method of claim **10** wherein, for said device:

said second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

12. The method of claim **11** wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

13. The method of claim **11** wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

14. The method of claim **11**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

15. The method of claim **13**, wherein said gray level dependent additive noise is spatially dependent.

16. The method of claim **11**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

17. The method of claim **16**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

18. A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space through use of chromatic response characteristic functions; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device independent color space through the use of spatial characteristic fimctions describing image spatial transform characteristics in said device independent color space.

19. The system of claim **18**, wherein the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

20. The system of claim **19**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

21. The system of claim **18**, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

22. The system of claim **18**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

23. The system of claim **22**, wherein said gray level dependent additive noise is spatially dependent.

24. The system of claim **18**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

25. The system of claim **24**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

26. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

27. The device profile of claim **26** wherein, for said device, the data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

28. The device profile of claim **27**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

29. The device profile of claim **26**, wherein the data is represented by characteristic functions describing a gray level dependent additive noise in said device.

30. The device profile of claim **26**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

31. The device profile of claim **30**, wherein said gray level dependent additive noise is spatially dependent.

32. The device profile of claim **26**, wherein the data is represented by characteristic functions describing spatially dependent additive noise in said device.

33. The device profile of claim **32**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

* * * * *

John J. Edmonds (SBN 274200)
jedmonds@cepiplaw.com
COLLINS EDMONDS POGORZELSKI
SCHLATHER & TOWER, PLLC
1851 East First Street Suite 900
Santa Ana, CA 92705
Telephone: 951-708-1237
Facsimile: 951-824-7901

Attorney for Plaintiff
DIGITAL IMAGE TECHNOLOGIES, LLC

UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA
WESTERN DIVISION

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. 8:12-cv-1324-ODW-MRWx PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. BUY.COM, INC., Defendant.	CASE NO. 8:12-cv-1668-ODW-MRWx PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. B AND H FOTO AND ELECTRONICS CORP., Defendant.	CASE NO. 8:12-cv-1671-DW(MRWx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SAKAR INTERNATIONAL, INC.	CASE NO. 8:12-CV-1673-ODW (MRWx) PLAINTIFF'S NOTICE OF APPEAL

d/b/a VIVITAR, Defendant.	Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. MAMIYA DIGITAL IMAGING CO., LTD.; LEAF IMAGING, LTD.; MAMIYA AMERICA CORP, Defendants.	CASE NO. 8:12-CV-1675-ODW (MRW) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. LEICA CAMERA AG and LEICA CAMERA INC., Defendants.	CASE NO. 8:12-cv-1677-ODW (MRWx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. 8:12-cv-1679-ODW (MRWx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. GENERAL IMAGING CO., Defendants.	CASE NO. 8:12-cv-1680-ODW (MRWx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION ET AL., Defendant(s).	CASE NO. 8:12-cv-1681-ODW (MRWx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. MICRO ELECTRONICS, INC., Defendant.	CASE NO. 8:12-cv-1686-ODW-MRWx PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. OVERSTOCK.COM, INC., Defendant.	CASE NO. 8:12-cv-1687-ODW-MRWx PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. NEWEGG, INC.; NEWEGG.COM, INC., Defendants.	CASE NO. 8:12-cv-1688-ODW-MRWx PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. 8:12-cv-1689-ODW (MRWx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. XEROX CORPORATION, Defendant.	CASE NO. 8:12-cv-1693-ODW (MRWx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. 8:12-cv-1694-ODW (MRWx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. CDW LLC, Defendant.	CASE NO. 8:12-cv-1695-ODW-MRWx PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. VICTOR HASSELBLAD AB and HASSELBLAD USA INC., Defendants.	CASE NO. 8:12-cv-1696-ODW (MRWx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ASUS COMPUTER INTERNATIONAL and ASUSTEK COMPUTER INC., Defendants.	CASE NO. 8:12-cv-2122 ODW (SSx) PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. TOSHIBA CORP.; TOSHIBA AMERICA, INC.; TOSHIBA AMERICA BUSINESS, Defendants.	CASE NO. 8:12-cv-2127-ODW-MRWx PLAINTIFF'S NOTICE OF APPEAL Judge: Hon. Otis D. Wright, II

Notice is hereby given that Plaintiff Digitech Image Technologies LLC hereby appeals to the United States Court of Appeals for the Federal Circuit for each of the above styled and following cases:

a. *Digitech Image Technologies LLC v. Electronics for Imaging, Inc.* (8:12-cv-1324-ODW-MRWx);
b. *Digitech Image Technologies LLC v. Buy.Com, Inc.* (8:12-cv-1668-ODW-MRWx);
c. *Digitech Image Technologies LLC v. B and H Foto and Electronics Corp.* (8:12-cv-1671-ODW-MRWx);
d. Digi*tech Image Technologies LLC v. Sakar International, Inc.* (8:12-cv-1673-ODW-MRWx);
e. *Digitech Image Technologies LLC v. Mamiya Digital Imaging Co., Ltd.; Leaf Imaging, Ltd.; Mamiya America Corp.* (8:12-cv-1675-ODW-MRWx);
f. *Digitech Image Technologies LLC v. Leica Camera AG; Leica Camera, Inc.* (8:12-cv-1677-ODW-MRWx);
g. *Digitech Image Technologies LLC v. Fujifilm Corp.* (8:12-cv-1679-ODW-MRWx);
h. *Digitech Image Technologies LLC v. General Imaging Co.* (8:12-cv-1680-ODW-MRWx);
i. *Digitech Image Technologies LLC v. Sigma Corp.; Sigma Corp. of America* (8:12-cv-1681-ODW-MRWx);
j. *Digitech Image Technologies LLC v. Micro Electronics, Inc.* (8:12-cv-1686-ODW-MRWx);
k. *Digitech Image Technologies LLC v. Overstock.com, Inc.* (8:12-cv-1687-ODW-MRWx);
l. *Digitech Image Technologies LLC v. Newegg, Inc.; Newegg.com, Inc.* (8:12-cv-1688-ODW-MRWx);
m. *Digitech Image Technologies LLC v. Pentax Ricoh Imaging Co., Ltd.; Pentax Ricoh Imaging Americas Corp.; Ricoh Co., Ltd.; Ricoh Americas Corp.* (8:12-cv-1689-ODW-MRWx);
n. *Digitech Image Technologies LLC v. Xerox Corp. (8:12-cv-1693-ODW-MRWx*);
o. *Digitech Image Technologies LLC v. Konica Minolta Business Solutions USA, Inc.* (8:12-cv-1694-ODW-MRWx);
p. *Digitech Image Technologies LLC v. CDW LLC* (8:12-cv-1695-ODW-MRWx);

q. *Digitech Image Technologies LLC v. Victor Hasselblad AB; Hasselblad USA, Inc.* (8:12-cv-1696-ODW-MRWx);

r. *Digitech Image Technologies LLC v. Asus Computer International; Asustek Computer, Inc.* (8:12-cv-2122-ODW-MRWx); and

s. *Digitech Image Technologies LLC v. Toshiba Corp.; Toshiba America, Inc.; Toshiba America Business Solutions, Inc.; Toshiba America Information Systems, Inc.* (8:12-cv-2127-ODW-MRWx)

from the Order(s) granting the motion(s) for summary judgment (*Digitech Image Techs., LLC v. Elecs. for Imaging, Inc.*, No. 8:12-cv-1324-ODW-MRWx (C.D. Cal. July 31, 2013) (ECF No. 88)) (Exhibit 1),[1] and also from the Judgments entered in each such case on August 6 and/or 7, 2013, including as follows:

a. ECF No. 93 in *Digitech Image Technologies LLC v. Electronics for Imaging, Inc*. (8:12-cv-1324-ODW-MRWx);

b. ECF No. 22 in *Digitech Image Technologies LLC v. Buy.Com, Inc.* (8:12-cv-1668-ODW-MRWx);

c. ECF No. 29 in *Digitech Image Technologies LLC v. B and H Foto and Electronics Corp.* (8:12-cv-1671-ODW-MRWx);

d. ECF No. 29 in Digi*tech Image Technologies LLC v. Sakar International, Inc.* (8:12-cv-1673-ODW-MRWx);

e. ECF No. 40 in *Digitech Image Technologies LLC v. Mamiya Digital Imaging Co., Ltd.; Leaf Imaging, Ltd.; Mamiya America Corp.* (8:12-cv-1675-ODW-MRWx);

f. ECF No. 40 in *Digitech Image Technologies LLC v. Leica Camera AG; Leica Camera, Inc.* (8:12-cv-1677-ODW-MRWx);

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[1] The Order Granting Motion for Summary Judgment was entered on July 31, 2013 in the following cases: (1) *Digitech Image Techs., LLC v. Elecs. for Imaging*, Inc., No. 8:12-cv-1324-ODW(MRWx) (ECF No. 88) (lead consolidated case); (2) *Digitech Image Technologies LLC v. Sigma Corporation et al.*, No. 8:12-cv-01681-ODW-MRW (ECF No. 30); (3) *Digitech Image Technologies LLC et al v. Pentax Ricoh Imaging Co Ltd et al*,. 8:12-cv-01689-ODW-MRW (ECF No. 36); (4) *Digitech Image Technologies LLC v. Konica Minolta Business Solutions USA, Inc.*, No. 8:12-cv-1694-ODW(MRWx) (ECF No. 36); and (5) *Digitech Image Technologies LLC v. Fujifilm Corp.* (8:12-cv-1679-ODW-MRWx) (ECF No. 35); and it was stipulated to be applicable to all pending cases (Exhibit 2) in this consolidated (Exhibit 3) litigation.

g. ECF No. 36 in *Digitech Image Technologies LLC v. Fujifilm Corp.* (8:12-cv-1679-ODW-MRWx);

h. ECF No. 24 in *Digitech Image Technologies LLC v. General Imaging Co.* (8:12-cv-1680-ODW-MRWx);

i. ECF No. 31 in *Digitech Image Technologies LLC v. Sigma Corp.; Sigma Corp. of America* (8:12-cv-1681-ODW-MRWx);

j. ECF No. 23 in *Digitech Image Technologies LLC v. Micro Electronics, Inc.* (8:12-cv-1686-ODW-MRWx);

k. ECF No. 23 in *Digitech Image Technologies LLC v. Overstock.com, Inc.* (8:12-cv-1687-ODW-MRWx);

l. ECF No. 39 in *Digitech Image Technologies LLC v. Newegg, Inc.; Newegg.com, Inc.* (8:12-cv-1688-ODW-MRWx);

m. ECF No. 38 in *Digitech Image Technologies LLC v. Pentax Ricoh Imaging Co., Ltd.; Pentax Ricoh Imaging Americas Corp.; Ricoh Co., Ltd.; Ricoh Americas Corp.* (8:12-cv-1689-ODW-MRWx);

n. ECF No. 29 in *Digitech Image Technologies LLC v. Xerox Corp.* (8:12-cv-1693-ODW-MRWx);

o. ECF No. 38 in *Digitech Image Technologies LLC v. Konica Minolta Business Solutions USA, Inc.* (8:12-cv-1694-ODW-MRWx);

p. ECF No. 30 in *Digitech Image Technologies LLC v. CDW LLC* (8:12-cv-1695-ODW-MRWx);

q. ECF No. 25 in *Digitech Image Technologies LLC v. Victor Hasselblad AB; Hasselblad USA, Inc.* (8:12-cv-1696-ODW-MRWx);

r. ECF No. 19 in *Digitech Image Technologies LLC v. Asus Computer International; Asustek Computer, Inc.* (8:12-cv-2122-ODW-MRWx); and

s. ECF No. 21 in *Digitech Image Technologies LLC v. Toshiba Corp.; Toshiba America, Inc.; Toshiba America Business Solutions, Inc.; Toshiba America Information Systems, Inc.* (8:12-cv-2127-ODW-MRWx).

Plaintiff also appeals to the United States Court of Appeals for the Federal Circuit all other opinions, orders, findings, or rulings prior to, during, or after the summary judgments and/or judgments in the above cases that were adverse to Plaintiff, including adverse the validity and/or patentability of the patent-in-suit.

August 28, 2013

/s/ *John J. Edmonds*
John J. Edmonds

COLLINS EDMONDS POGORZELSKI SCHLATHER & TOWER PLLC

Attorney for Plaintiff
DIGITECH IMAGE TECHNOLOGIES LLC

CERTIFICATE OF SERVICE

I, John J. Edmonds, declare as follows:

I am over the age of eighteen years and am not a party to this action. I am employed at the law firm of Collins, Edmonds, Pogorzelski, Schlather & Tower, PLLC and I am a member of the bar of this Court. I hereby certify that on August 28, 2013 the following document was transmitted via the Court's Electronic Case Filing (ECF) system:

PLAINTIFF'S NOTICE OF APPEAL

I further certify that the attached document was sent on August 28, 2013 via the Court's Electronic Case Filing (ECF) system to all counsel of record each of the above-styled actions.

August 28, 2013

/s/ *John J. Edmonds*
John J. Edmonds

COLLINS EDMONDS POGORZELSKI SCHLATHER & TOWER PLLC

Attorney for Plaintiff
DIGITECH IMAGE TECHNOLOGIES LLC

EXHIBIT 1

Case 8:12-cv-01324-ODW-MRW Document 88 Filed 07/31/13 Page 1 of 17 Page ID #:2685

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC. et al., Defendants.	Case No. 8:12-cv-1324-ODW(MRWx) **ORDER GRANTING MOTION FOR SUMMARY JUDGMENT [64]**

I. INTRODUCTION

Under 35 U.S.C. § 101, patent claims must be directed to one of the four patent-eligible subject-matter categories: processes, machines, manufactures, or compositions of matter. Inventions that fit within one or more of the statutory categories are nonetheless patent ineligible if they are coextensive with laws of nature, natural phenomenon, or abstract ideas, unless the inventions include substantive limitations that would add "significantly more" to the underlying principles. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1294 (2012).

Plaintiff Digitech Image Technologies LLC's '415 Patent claims a device profile and a method of generating a device profile.[1] A device profile describes the

[1] U.S. Patent No. 6,128,415, claims 1–6, 9, 10–15, and 26–31.

color and spatial properties of a device so that a processed image can be more accurately captured, transformed, or rendered, minimizing color and spatial distortions produced by an imaging device. ('415 Patent 1:8–11; 1:32–34.) Although past attempts to correct these image distortions are not new, they have been device dependent. (*Id.* at 1:35–36.) The '415 Patent seeks to improve digital-imaging processing through use of device-independent device profiles by applying a device-independent paradigm for the spatial characterization. (*Id.* at 1:64–2:1; 2:4–9.)

Defendants assert that these claims either fall outside the four subject-matter categories or merely describe an ineligible abstract idea.[2] For the reasons discussed below, the Court finds that the asserted claims are patent ineligible and **GRANTS** Defendants' Motion for Summary Judgment of Invalidity.[3] (ECF No. 64.)

II. LEGAL STANDARD

Summary judgment should be granted if there are no genuine issues of material fact and the moving party is entitled to judgment as a matter of law. Fed. R. Civ. P. 56(c). The moving party bears the initial burden of establishing the absence of a genuine issue of material fact. *Celotex Corp. v. Catrett*, 477 U.S. 317, 323–24 (1986). Once the moving party has met its burden, the nonmoving party must go beyond the pleadings and identify specific facts through admissible evidence that show a genuine issue for trial. *Id.*; Fed. R. Civ. P. 56(c). Conclusory or speculative testimony in affidavits and moving papers is insufficient to raise genuine issues of fact and defeat summary judgment. *Thornhill's Publ'g Co. v. GTE Corp.*, 594 F.2d 730, 738 (9th Cir. 1979).

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[2] Defendants FUJIFILM Corp.; Sigma Corp.; Sigma Corp. of America; Pentax Ricoh Imaging Co., Ltd.; Pentax Ricoh Imaging Americas Corp.; Ricoh Company, Ltd.; Ricoh Americas Corp.; and Konica Minolta Business Solutions, U.S.A., Inc. bring this Motion for Summary Judgment. The Court enters this order in each of the separate cases as well as in the lead case: 8:12-cv-1324-ODW(MRWx); 8:12-cv-1679-ODW(MRWx); 8:12-cv-1681-ODW(MRWx); 8:12-cv-1689-ODW(MRWx); 8:12-cv-1694-ODW(MRWx).

[3] Having considered the papers filed in support of and in opposition to this Motion, the Court deems the matter appropriate for decision without oral argument. Fed. R. Civ. P. 78; L.R. 7–15.

A genuine issue of material fact must be more than a scintilla of evidence, or evidence that is merely colorable or not significantly probative. *Addisu v. Fred Meyer*, 198 F.3d 1130, 1134 (9th Cir. 2000). A disputed fact is "material" where the resolution of that fact might affect the outcome of the suit under the governing law. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248 (1968). An issue is "genuine" if the evidence is sufficient for a reasonable jury to return a verdict for the nonmoving party. *Id.* Where the moving and nonmoving parties' versions of events differ, courts are required to view the facts and draw reasonable inferences in the light most favorable to the nonmoving party. *Scott v. Harris*, 550 U.S. 372, 378 (2007).

III. DISCUSSION

"Anything under the sun" may be considered an invention, but only those satisfying the conditions under § 101 are patentable. *Bilski v. Kappos*, 130 S. Ct. 3218, 3249 (2010). Determinations of patent eligibility are questions of law and require a two-step analysis. *CyberSource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1369 (Fed. Cir. 2011); *Bilski*, 130 S. Ct. at 3225. First, the claimed invention must fall within one of the four eligible subject-matter categories: processes, machines, manufactures, or compositions of matter. *Bilski*, 130 S. Ct. at 3225; 35 U.S.C. § 101. Second, if the claimed invention falls within one of the four categories, it still must not wholly embrace one of the three judicially recognized exceptions: laws of nature, physical phenomena, and abstract ideas. *Bilski*, 130 S. Ct. at 3225.

All inventions, at some level, "embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas." *Mayo*, 132 S. Ct. at 1293. So applying the judicially recognized exceptions too broadly would "eviscerate patent law." *Id.* And though a practical application of an abstract idea to a structure or process may be patented, "one must do more than simply state the [abstract idea] while adding the words 'apply it.'" *Id.* at 1294. Thus, the goal of § 101 is to guard against the "wholesale preemption of fundamental principles," while looking beyond mere claim-drafting strategies such as "highly stylized language, hollow field-of-use limitations,

or the recitation of token post-solution activity." *CLS Bank Int'l v. Alice Corp.*, No. 2011-1301, 2013 U.S. App. LEXIS 9493, at *28, 30 (Fed. Cir. May 10, 2013) (en banc) (Lourie, J., concurring).

The Supreme Court has eschewed the Federal Circuit's formulas for patent eligibility like the machine-or-transformation test and has directed courts to employ a "flexible, claim-by-claim approach to subject-matter eligibility that avoids rigid line drawings." *Id.* at *30–31. And as with all invalidity inquiries, a § 101 eligibility determination presupposes that a patent is entitled to a presumption of validity. *Microsoft Corp. v. i4i Ltd. P'ship*, 131 S. Ct. 2238, 2252 (2011); 35 U.S.C. § 282. Hence, a court must carefully consider "meaningful limitations" that prevent a claim from covering every practical application of a fundamental concept and preserve the claim's validity. *CLS Bank*, 2013 U.S. App. LEXIS 9493, at *29.

Although the parties do not contend that claim construction is necessary nor assert any particular constructions, the Court is obligated to first consider this issue. *State St. Bank & Trust. Co. v. Signature Fin. Grp.*, 149 F.3d 1368, 1370 (Fed. Cir. 1998) (explaining that the issue of § 101 patent eligibility is "a matter of both claim construction and statutory construction"). The only term needing construction in this § 101 analysis is the term "device profile," found in every asserted claim.

A. Claim construction

Claim construction is a question of law to be decided by the court. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc). In construing claim terms, the Court must begin with an examination of the claim language itself. *August Tech. Corp. v. Camtek, Ltd.*, 655 F.3d 1278, 1284 (Fed. Cir. 2011); *see also Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248 (Fed. Cir. 1998) ("The claims define the scope of the right to exclude; the claim construction inquiry, therefore, begins and ends in all cases with the actual words of the claim.").

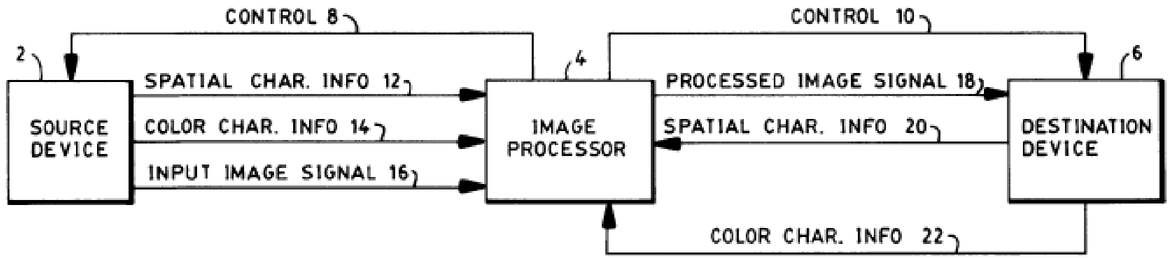
/ / /

The terms used in the claims are generally given their "ordinary and customary meaning." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). This "ordinary and customary meaning" is the meaning as understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips*, 415 F.3d at 1313. A patentee is presumed to have intended the ordinary meaning of a claim term in the absence of an express intent to the contrary. *Id*. In some instances, a term's ordinary meaning may be readily apparent, in which case the court need only apply the widely accepted meaning of commonly understood words. *Acumed LLC v. Stryker Corp.*, 483 F.3d 800, 805 (Fed. Cir. 2007).

The person of ordinary skill in the art is deemed to read the claim term in the context of the entire patent. *Phillips*, 415 F.3d at 1313. Thus, claim terms are interpreted in light of the intrinsic evidence of record, including the specification, written description, drawings, and prosecution history. *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1324–25 (Fed. Cir. 2002).

Courts may also rely on extrinsic evidence, such as expert testimony, dictionaries, and learned treatises, to better understand the underlying technology and to determine what a person of ordinary skill in the art would understand the claim terms to mean. *Phillips*, 415 F.3d at 1317–18. But while extrinsic evidence can be useful, it is less reliable and less significant than the intrinsic record in determining the meaning of claim language. *Id*. at 1318. Particularly, expert testimony should be discounted if it is "clearly at odds with the claim construction mandated by the claims" or are merely conclusory, unsupported assertions. *Id.*

The '415 Patent describes a digital-image processing system comprising a source (image-acquisition) device, an image processor, and an output device. ('415 Patent 2:49–63.) Color-characteristic and spatial-characteristic information relating to the source and output devices is passed to the image processor along with image data, allowing the processor to more accurately capture, transform, or render an image. ('415 Patent 2:49–3:11.) This is represented in the following diagram:



('415 Patent, Fig. 1.)

The specification refers to a tagged file structure as a device profile. ('415 Patent 1:66–67.) This device profile can include a "characterization of a device's image pixel data in device independent color space" as well as "spatial characteristics" of the device. ('415 Patent 1:64–2:3.) It is clear that these characteristics are just numerical data, whether raw or calculated. ('415 Patent 1:55–64 (color characteristics can be represented by "image pixel data (digits) in a device independent color space—e.g. CIE L*a*b* or CIE XYZ"); '415 Patent 3:12–31 (spatial characteristics can be represented by mathematical functions describing "added noise and image signal transform characteristics" or "a gray level dependent additive noise").)

The Court finds no reason to construe the term "device profile" to mean anything other than its plain and ordinary meaning. Synonyms that may be appropriate are tagged file structure,[4] data set, or paradigm—but these do no better job at describing "device profile" than its plain and ordinary meaning. What is certain,

[4] Digitech contends that a device profile can exist as "a 'tag' appended to a digital image obtained using a digital image processing system," and is therefore a tangible object. (Opp'n 8.) There are two problems with this statement. First, the specification points out that the characterization of a device "is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device." Thus, it is the imaging device that has this device profile or tag; the tag is not part of a digital image. ('415 Patent 1:64–2:1.) Second, while a tag may exist as an appendage of a digital image, it is not a tangible object. A case may be made that data describing a digital image should be considered tangible. *See In re Abele*, 684 F.2d 902, 908–09 (C.C.P.A. 1982) (holding that electronic transformation of data into a visual depiction of body tissues satisfied the transformation test for patent eligibility). But data describing a device profile is many shades less tangible—not only does it not *represent* anything tangible, it only represents intangible properties of a device.

and most relevant in this § 101 analysis, is that the meaning of "device profile" does not connote being a physical object, comprising a physical component, or having a physical manifestation. *See In re Ferguson*, 558 F.3d 1359, 1365–66 (Fed. Cir. 2009) ("Paradigm claims do not recite a concrete thing, consisting of parts, or of certain devices and combination of devices." (internal quotation marks omitted)).

Turning to the asserted claims, these can be divided into two categories of claims: ones for a device profile (claims 1–6, 9, and 26–31); and ones for a method of generating a device profile (claims 10–15). The Court first addresses the device-profile claims, and then proceeds to analyze the remaining claims.

B. The device-profile claims (claims 1–6, 9, and 26–31) do not fall within any of the four statutory categories for patent eligibility

Claims 1 and 26 are the two independent claims of the '415 Patent directed to a device profile:

> 1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:
>
> first data for describing a device dependent transformation of color information content of the image to a device independent color space; and
>
> second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.
>
> 26. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

('415 Patent 5:33–41; 7:8–15.) Section 101 demands that the claimed invention be a process, machine, manufacture, or composition of matter. *Bilski*, 130 S. Ct. at 3225. Claims 1 and 26 are none of these.

Claim 1 describes a device profile. This profile comprises a first piece of data relating to color information, and a second piece of data relating to spatial information. Nothing in claim 1 describes anything tangible.

To qualify as a machine under § 101, it must be a "concrete thing." *In re Nuijten*, 500 F.3d 1346, 1355 (Fed. Cir. 2007). Intangible things such as "a transitory signal made of . . . electromagnetic variances . . . [may be] physical and real, [but] it does not possess concrete structure in the sense implied" under § 101. *Id.* A device profile is nothing more than an intangible set of data—it is nothing more than numbers. *See In re Warmerdam*, 33 F.3d 1354, 1362–63 (Fed. Cir. 1994) (holding that a "data structure" relating to a hierarchy of bubbles was patent ineligible because it only referred to the manipulation of ineligible, purely mathematical ideas).

Similarly, a manufacture must be tangible. A manufacture refers to articles resulting from processing materials to give these materials new forms, qualities, properties, or combinations. *Id.* at 1356. Notably, the term "manufacture" as used in the statute is a noun. *Bayer AG v. Housey Pharm., Inc.*, 340 F.3d 1367, 1373 (Fed. Cir. 2003). So, "manufacture" does not refer to the making or modifying of data, signals, or other intangible objects. *See Nuijten*, 500 F.3d at 1356–57. A device profile is just data, something intangible and not considered a manufacture. And the fact that a device profile is made of a color component and a spatial component does not qualify it as a manufacture—a combination of intangible objects does not create a tangible one.

Further, a device profile is not a composition of matter. A composition of matter is defined as "all compositions of two or more substances and . . . all composite articles, whether they be the results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids." *Diamond v. Chakrabarty*, 447 U.S. 303, 308 (1980) (internal quotation marks omitted). Digitech contends that a device profile is a composition of matter but fails to explain how that is so. (Opp'n 19.) The key word in this category is "matter"—meaning that the claimed object must be

tangible. A device profile, however composed of different bits of data, cannot constitute matter.

Finally, a device profile is not a process. A process requires action; it is "an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing." *Gottschalk v. Benson*, 409 U.S. 63, 70 (1972) (internal quotation marks omitted). Digitech does not argue that a device profile is a process, and the Court sees no reason how it could be. Thus, failing to fall within one of the four patent-eligible subject-matter categories, claim 1 is invalid under § 101.

In the same way, the device profile in claim 26 fails to fall within one of the four statutory categories. Claim 26 differs from claim 1 in that it only includes claim 1's "second data" for describing a device-dependent transformation of spatial-information content of a image to a device-independent color space. ('415 Patent 7:8–13.) Claim 26 also adds an additional limitation over claim 1 by defining that the data is represented by spatial-characteristic functions through the "use of spatial stimuli and device response" for the device. ('415 Patent 7:13–15.) But though claim 26 recites verbs "use" and "is represented," this claim is not a process claim; it is a product-by-process claim, "in which the product is defined at least in part in terms of the method or process by which it is made." *SmithKline Beecham Corp. v. Apotex Corp.*, 439 F.3d 1312, 1315 (Fed. Cir. 2006) (internal quotation marks omitted). Product-by-process claims are directed to the ultimate product, and not the underlying process. *Nuijten*, 500 F.3d at 1355. Therefore, claim 26's additional limitation is insufficient to propel the claim into one of the four statutory categories and the claim must be found invalid.

For the same reasons, dependent claims 2–6, 9, and 27–31 cannot rectify the patent-ineligibility problem of their independent claims 1 and 26. These dependent claims only add limitations and make them at most, product-by-process claims. These additional limitations cannot transmute intangible device profiles into patent-eligible subject matter. It follows that these dependent claims must also be found invalid.

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C. The device-profile method claims (claims 10–15) do not describe a patent-eligible process because they fail the machine-or-transformation test

Unlike claims 1 and 26, claim 10 is a method claim. Claim 10 describes a method of generating device profiles that closely mirrors claim 1:

> 10. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:
>
> generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;
>
> generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and
>
> combining said first and second data into the device profile.

('415 Patent 6:1–16.)

The parties dispute whether claim 10 falls within the process category of § 101. One important and useful tool to determine whether an invention is a patent-eligible process is the machine-or-transformation test. *Bilski*, 130 S. Ct. at 3227. Though it is not the sole test for patent eligibility, it has been historically true that inventions failing the machine-or-transformation test were rarely granted patents. *Id.* Under this test, a claimed process could be patent-eligible only if "(1) it is tied to a particular machine or apparatus; or (2) it transforms a particular article into a different state or thing." *CyberSource*, 654 F.3d at 1369. But passing this test is no guarantee for patentability; not everything that produces a "useful, concrete, and tangible result" is patentable. *Bilski*, 130 S. Ct. at 3259 (Breyer, J., concurring).

Claim 10 fails the machine prong of this test because it recites no particular machine or apparatus. It is conceivable that this claimed process could be performed by a specialized processor or a general-purpose computer because claim 10 prescribes three separate steps to generate a device profile from preexisting data: (1) generating

first data relating to color information through measured chromatic stimuli and device response characteristic functions; (2) generating second data relating to spatial information through spatial stimuli and device response characteristic functions; and (3) combining the first and second data into a device profile. But even if it is assumed that a processor or computing device plays a central role in this claim, it appears such a device would only be employed for repetitive calculations, and would not "impose meaningful limits on the claim's scope." *CyberSource*, 654 F.3d at 1369; *see Bancorp Servs., L.L.C. v. Sun Life Assurance Co. of Canada (U.S.)*, 687 F.3d 1266, 1278 (Fed. Cir. 2012) (holding that a computer used to manage a stable-value-protected life-insurance policy does not impose meaningful limits on the scope of the claims). Though the "generating" computations may be time-consuming, they are straightforward transfer functions that could be done by pencil-and-paper if the source data is not too complex. Thus, because claim 10 is not tethered to a machine or apparatus (either explicitly or implicitly), claim 10 cannot satisfy the machine prong of the test.

This claimed process fairs no better under the transformation prong. To satisfy this prong, a claimed process must "transform an article into a different state or being." *In re Bilski*, 545 F.3d 943, 962 (Fed. Cir. 2008) (en banc). There is no doubt that this process involves the manipulation of data; some of the mathematical relationships behind these manipulations are provided in the patent specification. ('415 Patent 3:47–4:9, 4:42–64.) But the "mere manipulation or reorganization of data . . . does not satisfy the transformation prong." *CyberSource*, 654 F.3d at 1375. Here, only data is transformed—and it is transformed into different data through mathematical relationships. And though these mathematical relationships may be complex and the data manipulations computationally exhaustive, this does not satisfy the transformation prong. The process of claim 10 mathematically transforms intangible device properties into intangible data describing those properties. This transformation differs from ones that result in an intangible representation of a

physical object. *See In re Bilski*, 545 F.3d at 962 (clarifying that in *Abele*, the "electronic transformation of the data itself into a visual depiction" of body tissues was sufficient to satisfy the transformation prong. *In re Abele*, 684 F.2d at 908–09). Accordingly, claim 10 fails the transformation prong.

D. The device-profile method claims (claims 10–15) are otherwise patent ineligible because they merely describe an abstract idea

Even if claim 10 is deemed a process, the parties differ whether claim 10 merely describes an abstract idea, and is therefore ineligible for patenting. *Bilski*, 130 S. Ct. at 3225. A meaningful exercise is to first identify the abstract idea. *CLS Bank*, 2013 U.S. App. LEXIS 9493, at *33. Here, the abstract idea is the generation of a device profile through mathematical correlations. This was admitted to the Patent Office during prosecution of the patent:

> [W]ith regards to the present invention, to enable optimization, the Applicants developed something referred to as a 'profile' which contains an *abstract description* of the spatial response properties of any device in question (i.e., input device, display device, or output device; noise response and sharpness response).

(Yen Decl., Ex. B, at 120 (emphasis added).)

While an application of an abstract idea, such as a mathematical formula, to a known structure may qualify for patent protection, "to transform an unpatentable [abstract idea] into a patent-eligible *application* of such a law, one must do more than simply state the [abstract idea] while adding the words 'apply it.'" *Mayo*, 132 S. Ct. at 1293–94. Several cases illustrate the § 101 tension between patent-eligible subject matter and an unpatentable abstract idea.

First, in *Benson*, the Supreme Court considered a computer-implemented method for converting binary-coded decimal (BCD) numerals into pure binary numerals. *Gottschalk v. Benson*, 409 U.S. 63, 64 (1972). After identifying the algorithm behind the conversion, the Court concluded that the claims were "so abstract and sweeping as to cover both known and unknown uses of the BCD to pure

binary conversion," and would therefore preclude every application of the algorithm. *Id.* at 68.

Then, in *Flook*, the Supreme Court evaluated the patent eligibility of a computerized method for updating alarm limits for a continuously monitored industrial process. *Parker v. Flook*, 437 U.S. 584, 585–86 (1978). This method involved measuring the present value of a process variable, using the disclosed mathematical formula to calculate a new alarm limit in view of the present value, and adjusting the previous alarm limit to the newly calculated limit. *Id.* at 586–87. The Court concluded that although the claim did not "wholly preempt" the mathematical formula, the claimed process was ineligible for patenting because it was an abstract idea that failed to contain sufficient substance beyond the formula itself. *Id.* at 589, 594.

These two cases can be contrasted with *Diehr*, where the Supreme Court held claims drawn to a process for curing synthetic rubber, using a mathematical formula, to be patent eligible. *Diamond v. Diehr*, 450 U.S. 175, 177 (1981). Although the claimed process incorporated a mathematical formula known as the Arrhenius equation, the process called for substantive steps aside from the equation, such as a step to constantly measure the actual temperature inside the rubber mold. *Id.* at 178–79, 187. This was deemed to be a specific application instead of an abstract idea in isolation, because the patentees "only [sought] to foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process," and not total preemption of the equation. *Id.* at 187.

But claim 10 is nothing more than an abstract idea—it employs algorithms that manipulate collected data. This is not enough: "if a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory." *Flook*, 437 U.S. at 595 (quoting *In re Richman*, 563 F.2d 1026, 1030 (C.C.P.A. 1977)). This broad, structureless claim preempts the entire field of device-independent characterization

paradigms for digital-image processing and cannot be said to be patent-eligible subject matter.

Digitech argues three points in its attempt to show that claim 10 has structural limitations, even though they don't appear in the claim language: first, claim 10 requires an input device such as a camera (Opp'n 23); second, claim 10's required measurements must be done with specialized electronic equipment such as a microdensitometer (*id.* at 23–24); third, the required calculations need a processor because they are nonlinear and must be done in an extremely short amount of time (*id.* at 24). These creative arguments ring hollow.

The Court discounts the first two arguments because claim 10 clearly recites no such structural elements, and claim 10 is written in such a way as to not require any structural elements. The claimed process manipulates incoming color and spatial data, regardless where the data comes from or how the data is captured. And as for Digitech's contention that the claimed process requires a processor because the math is impossible for humans, this argument has been foreclosed by the Federal Circuit: "[S]imply appending generic computer functionality to lend speed or efficiency to the performance of an otherwise abstract concept does not meaningfully limit claim scope for purposes of patent eligibility." *CLS Bank*, 2013 U.S. App. LEXIS 9493, at *29 (citing *Bancorp*, 687 F.3d at 1278, and *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333–34 (Fed. Cir. 2012) (finding that the claimed computer-aided clearinghouse process is a patent-ineligible abstract idea)); *SiRF Tech., Inc. v. Int'l Trade Comm'n*, 601 F.3d 1319, 1333 (Fed. Cir. 2010) ("In order for the addition of a machine to impose a meaningful limit on the scope of a claim, it must play a significant part in permitting the claimed method to be performed, rather than function solely as an obvious mechanism for permitting a solution to be achieved more quickly, i.e., through the utilization of a computer for performing calculations.").

Finally, like claims 1 and 26's dependent claims discussed above, dependent claims 11–15 only limit the type of algorithms that may be employed, such as Wiener

noise power spectra and gray-level dependent noise masks. ('415 Patent 6:21–32.) These dependent claims do not add any meaningful limitations—they are just trivial ones as explained in the specification:

> In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, the characteristic processing section 30 contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. [P]atent [A]pplication Ser. No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation.

('415 Patent 3:14–27.) Thus, these dependent claims cannot salvage an unpatentable principle and transform it into a patentable process. *Mayo*, 132 S. Ct. 1289 at 1302; *Bilski*, 130 S. Ct. at 3230 ("[T]he prohibition against patenting abstract ideas 'cannot be circumvented by attempting to limit the use of the formula to a particular technological environment' or adding 'insignificant postsolution activity.'" (quoting *Diehr*, 450 U.S. at 191–92)).

E. Digitech mischaracterizes its patent claims as ones directed to a digital-image processing system

Throughout its Opposition, Digitech asserts that the claimed invention is a digital-image processing system, either in part or in whole. (Opp'n 6–7, 12–13, 19, 22–23, 24–25.) Though this may be the claimed invention in unasserted claims 18–25, this is not the claimed invention for the asserted claims. The asserted claims recite no structure—it is this deficiency that makes the claims broad and unpatentable.

Having found the asserted claims invalid, the Court declines to opine whether the remaining, unasserted claims are patent ineligible. The Court also recognizes that there may be patentable subject matter disclosed in the '415 Patent, and claims may be drafted (or have been drafted in a related patent) that fully satisfy § 101's eligibility requirements. But this is not the issue here. The asserted claims as drafted in the '415

Patent are intangible, possess no meaningful non-abstract limitations, and are therefore ineligible for patent protection under § 101.

F. Digitech's alleged issues of material fact fail to defeat summary judgment

As a last-ditch effort, Digitech asserts that summary judgment is inappropriate because there are outstanding genuine issues of material fact, and filed a separate Statement of Genuine Disputes of Material Fact. (Opp'n 2–3; ECF No. 73-6.) Not only does Digitech fail to adequately explain what these disputed facts are and how they relate to this § 101 analysis, but most of Digitech's identified issues are not questions of fact—they are questions of law. The remainder of the alleged questions of fact (e.g., whether the claims could be "practiced on a piece of paper" (Statement of Genuine Disputes of Material Fact ¶ 24)) are insignificantly probative to a collateral issue or are entirely irrelevant to this § 101 analysis. As a matter of fact, Digitech's concern is misplaced; determinations of patent eligibility are questions of law. *CyberSource*, 654 F.3d at 1369.

IV. CONCLUSION

As discussed, the Court finds claims 1–6, 9, 10–15, and 26–31 of the '415 Patent invalid under § 101 because they are directed towards patent-ineligible subject matter. Accordingly, Defendants' Motion for Summary Judgment is **GRANTED**.

IT IS SO ORDERED.

July 31, 2013

OTIS D. WRIGHT, II
UNITED STATES DISTRICT JUDGE

EXHIBIT 2

John J. Edmonds (State Bar No. 274200)
jedmonds@cepiplaw.com
Stephen F. Schlather (admitted *pro hac vice*)
sschlather@cepiplaw.com
COLLINS EDMONDS POGORZELSKI
SCHLATHER & TOWER, PLLC
1851 East First Street, Suite 900
Santa Ana, California 92705
Telephone: (951) 708-1237
Facsimile: (951) 824-7901

Attorneys for Plaintiff,
Digitech Image Technologies, LLC

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SAKAR INTERNATIONAL, INC. d/b/a VIVITAR, Defendant.	CASE NO. 8:12-CV-01673-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v.	CASE NO. 8:12-CV-01675-ODW (MRW) JOINT STATUS REPORT

LEAF IMAGING LTD (d/b/a Mamiyaleaf), and MAMIYA AMERICA CORPORATION, Defendants.	Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. LEICA CAMERA AG and LEICA CAMERA INC., Defendants.	CASE NO. SACV 12-01677-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. GENERAL IMAGING CO., Defendants.	CASE NO. 8:12-cv-01680-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION ET AL.,	CASE NO. SACV 12-01681-ODW (MRWx) JOINT STATUS REPORT

Defendant(s).	Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. NIKON CORPORATION AND NIKON INC., Defendant.	CASE NO. SACV 12-01685-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01689-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. XEROX CORPORATION, Defendant.	CASE NO. SACV 12-01693-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01694-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. VICTOR HASSELBLAD AB and HASSELBLAD USA INC., Defendants.	CASE NO. 8:12-cv-01696-ODW (MRWx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. CASIO COMPUTER CO LTD, et al., Defendant(s).	CASE NO. SACV 12-01697-ODW (MRW) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ASUS COMPUTER INTERNATIONAL and ASUSTEK COMPUTER INC., Defendants.	CASE NO. SACV 12-02122 ODW (SSx) JOINT STATUS REPORT Judge: Hon. Otis D. Wright, II

Case 2:12-cv-03124-ODW-MRW Document 98-2 Filed 08/28/13 Page 6 of 12 Page ID #:2707

Plaintiff and the Defendants in the above-styled cases (collectively the "Parties") respectfully submit this joint status report, as follows:

On July 31, 2013 the Court ordered all Parties to file a joint status report by August 7, 2013, which must briefly state reasons why, in light of the Court's findings that claims 1-6, 9-15, and 26-31 of the patent-in-suit are invalid under 35 U.S.C. 101, the Court should not enter final judgment in favor of the Defendants.

The Parties jointly state that they are not aware of any reasons why, in light of the Court's findings that claims 1-6, 9-15, and 26-31 are invalid under 35 U.S.C. 101, [1] the Court should not enter final judgment in favor of Defendants.[2]

[1] Although not all Defendants in the non-stayed consolidated cases moved for summary judgment, Plaintiff acknowledges that the Court's ruling is applicable to such cases. Due to the consolidated nature of these cases, Plaintiff has no objection to final judgment being entered in all such cases, provided it is without prejudice to Plaintiff's ability to appeal the invalidity determination relative to all cases for which a final judgment is entered.

[2] Plaintiff respectfully intends to appeal the Court's summary judgment ruling and the final judgment resulting therefrom, and this joint status report should not be deemed a waiver of Plaintiff's appellate rights.

Dated: August 5, 2013

/s/ *John J. Edmonds*
John J. Edmonds

COLLINS EDMONDS
POGORZELSKI SCHLATHER &
TOWER PLLC

Attorney for Plaintiff
DIGITECH IMAGE
TECHNOLOGIES, LLC

/s/ *Joshua M. Masur*
Joshua M. Masur
(Cal. Bar No. 203510)
masur@turnerboyd.com
Turner Boyd LLP
2570 W. El Camino Real, Suite 380
Mountain View, California 94040
Telephone: (650) 521-5930
Facsimile: (650) 521-5931

Attorneys for Defendants
ASUS Computer International,
ASUSTeK Computer Inc., and
General Imaging Company

/s/ *Mark C. Johnson*
Mark C. Johnson
(admitted *pro hac vice*)
Kyle B. Fleming
(California Bar No. 166386)
Renner, Otto, Boisselle & Sklar, llp
1621 Euclid Avenue, Nineteenth Floor
Cleveland, Ohio 44115
Telephone: 216.621.1113
Facsimile: 216.621.6165

Attorneys for Victor Hasselblad AB and Hasselblad USA, Inc.

/s/Scott D. Stimpson
Scott D. Stimpson
(admitted *pro hac vice*)
sstimpson@sillscummis.com
SILLS CUMMIS & GROSS P.C.
30 Rockefeller Plaza
New York, NY 10112
Telephone: (212) 643-7000
Facsimile: (212) 643-6500

Attorneys for Defendants
CASIO AMERICA, INC. and
CASIO COMPUTER CO., LTD.

/s/ K. Tom Kohan
K. Tom Kohan, Esq.; SBN: 225420
KOHAN LAW FIRM
445 South Figueroa Street, 27th Floor
Los Angeles, California 90071
Tel: (310) 349-1111
Fax: (213) 612-7715
Email: tom@kohanlawfirm.com

/s/ Ezra Sutton
Ezra Sutton, Esq.
900 Route 9 North, Suite 201
Woodbridge, New Jersey 07095
Tel; (732) 634-3520
Fax: (732) 634-3511
Email: esutton@ezrasutton.com

Attorneys for Sakar International, Inc.

/s/ William C. Rooklidge
William C. Rooklidge (SBN 134483)
wrooklidge@jonesday.com
Frank P. Coté (SBN 204529)
fcote@jonesday.com
Mark L. Blake (SBN 253511)
mblake@jonesday.com
Jones Day
3161 Michelson Drive, Suite 800
Irvine, CA 92612.4408
Telephone: (949) 851-3939
Facsimile: (949) 553-7539

Attorneys for Defendant
Electronics For Imaging, Inc.

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/s/ J. Rick Taché
J. Rick Taché
Greenberg Traurig LLP
3161 Michelson Drive Suite 1000
Irvine, CA 92612
949-732-6500
Fax: 949-732-6501
Email: tacher@gtlaw.com

Attorneys for Defendants and Counterclaimants
Mamiya America Corporation and Leaf Imaging, Ltd

/s/ Daniel A. Sasse
Daniel A. Sasse (SBN 236234)
dsasse@crowell.com
CROWELL & MORING LLP
3 Park Plaza, 20th Floor
Irvine, CA 92614-8505
Telephone: 949-263-8400
Facsimile: 949-263-8414

Attorneys for Defendants Leica Camera Inc. and Leica Camera AG

/s/ Christopher P. Broderick
CHRISTOPHER P. BRODERICK (SBN 180254)
cbroderick@orrick.com
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: +1-213-629-2020
Facsimile: +1-213-612-2499
Attorney for Defendant FUJIFILM Corporation

/s/ Christopher P. Broderick
CHRISTOPHER P. BRODERICK
(SBN 180254)
cbroderick@orrick.com
ORRICK, HERRINGTON &
SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: +1-213-629-2020
Facsimile: +1-213-612-2499
Attorney for Defendants
Sigma Corporation and Sigma
Corporation of America

/s/ Christopher P. Broderick
CHRISTOPHER P. BRODERICK
(SBN 180254)
cbroderick@orrick.com
ORRICK, HERRINGTON &
SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: +1-213-629-2020
Facsimile: +1-213-612-2499
Attorney for Defendants
Pentax Ricoh Imaging Co., Ltd.;
Pentax Ricoh Imaging Americas
Corporation; Ricoh Company, Ltd.;
and Ricoh Americas Corp.

/s/ Christopher P. Broderick
CHRISTOPHER P. BRODERICK
(SBN 180254)
cbroderick@orrick.com
ORRICK, HERRINGTON &
SUTCLIFFE LLP

777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: +1-213-629-2020
Facsimile: +1-213-612-2499
Attorney for Defendant
Konica Minolta Business Solutions, U.S.A., Inc.

/s/ Christopher P. Broderick
CHRISTOPHER P. BRODERICK (SBN 180254)
cbroderick@orrick.com
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: +1-213-629-2020
Facsimile: +1-213-612-2499
Attorney for Defendants
Nikon Corporation and Nikon Inc.

/s/ Katrina M. Quicker
Katrina M. Quicker (*pro hac vice*)
BALLARD SPAHR LLP
999 Peachtree Street NE
Suite 1000
Atlanta, Georgia 30309
Telephone: 678-420-9300
Fax: 678-420-9301
Attorney for Defendant XEROX Corporation

CERTIFICATE OF SERVICE

I, John J. Edmonds, declare as follows:

I am over the age of eighteen years and am not a party to this action. I am employed at the law firm of Collins, Edmonds, Pogorzelski, Schlather & Tower, PLLC and I am a member of the bar of this Court. I hereby certify that on August 5, 2013the following document:

JOINT STATUS REPORT

was sent on August 5, 2013 via the Court's CM/ECF system to all counsel of record in this action.

August 5, 2013

/s/ *John J. Edmonds*
John J. Edmonds

EXHIBIT 3

UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

CIVIL MINUTES – GENERAL

No.	SACV 12-1324-ODW(MRWx)	Date	April 1, 2013
Title	Digitech Image Technologies LLC v. Electronics for Imaging, Inc. LEAD CASE – Applies to All Coordinated Action		

Present: The Honorable	Otis D. Wright, II, United States District Judge	
Christine Chung	Katie Thibodeaux	N/A
Deputy Clerk	Court Reporter / Recorder	Tape No.

Attorneys Present for Plaintiffs:	Attorneys Present for Defendants:
John J. Edmonds	William C. Rooklidge

Proceedings: SCHEDULING CONFERENCE

Case called and appearances made. The Court rules as follows.

This Minute Order applies to, and shall be filed in, all of the cases listed below (the "*Digitech* Cases"), which were filed by Plaintiff Digitech Image Technologies, LLC and include claims for infringement of United States patent 6,128,415. This Order applies to any cases subsequently filed by the Digitech alleging infringement of the same patent.

I. Relation and Coordination of Cases

The *Digitech* Cases are deemed related within the meaning of General Order 08-05 section 5 and Local Rule 83-1.3 because they will call for determination of the same and substantially similar questions of law or fact, will entail substantial duplication of labor if heard by different judges, and involve the same patents. The *Digitech* Cases are, until further order, coordinated for case-management purposes under Federal Rule of Civil Procedure 42. The Court will issue one protective order, one electronically stored information order, and one scheduling order to

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

CIVIL MINUTES – GENERAL

No.	SACV 12-1324-ODW(MRWx)	Date	April 1, 2013
Title	Digitech Image Technologies LLC v. Electronics for Imaging, Inc. LEAD CASE – Applies to All Coordinated Action		

govern all of the cases. All post-litigation communications, including hold letters and memoranda, may be excluded from all privilege logs. The parties are hereby **ORDERED** to file a joint brief addressing their respective positions on the protective and electronically-stored-information orders to be issued in this case. The joint brief shall not exceed 20 pages in length (excluding exhibits) and shall be filed no later than **April 15, 2013**. In addition, the stipulated protective order filed in *Digitech Image Technologies LLC v. Electronics for Imaging, Inc.*, No. 8:12-cv-01324, ECF No. 35 (C.D. Cal. filed Jan. 1, 2013), is hereby **VACATED**. That order will be replaced with a forthcoming protective order applicable in all of these consolidated cases.

This Order does not constitute a determination that these actions should be consolidated for trial, nor does it have the effect of making any entity a party to an action in which it has not been joined and served in accordance with the Federal Rules of Civil Procedure.

The low-number case, *Digitech Image Technologies LLC v. Electronics for Imaging, Inc.*, No. 8:12-cv-01324-ODW-MRW (C.D. Cal. filed Aug. 16, 2012), will serve as the master case file. All orders, pleadings, motions, and other documents will, when filed and docketed in the master case file, be deemed filed and docketed in each individual related case to the extent applicable. Parties shall enter their appearances in the individual cases, and the Clerk is directed to add all parties and attorneys from the individual cases to the master case file such that all counsel appearing in the individual cases will receive notifications for the master case file as well.

If orders, pleadings, motions, or other documents are generally applicable to all consolidated actions, they shall include in their caption the notation that they relate to "ALL CASES" and be filed and docketed only in the master file. Documents intended to apply only to particular cases will indicate in their caption the case number of the case(s) to which they apply and will only be filed in the individual cases.

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

CIVIL MINUTES – GENERAL

No.	SACV 12-1324-ODW(MRWx)	Date	April 1, 2013
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II. Discovery

A. Generally

Pursuant to the Court's Patent Standing Order, the Court hereby **REFERS** all discovery matters to this Court for all purposes. This Minute Order supersedes any representations made to the contrary in the Court's Scheduling and Case Management Order. This Order likewise supersedes Central District of California Local Rule 37 in its entirety.

All discovery responses must be verified.

The Court will handle all discovery disputes in the form of letter briefs, which shall be electronically filed as a "Notice of Discovery Dispute." For the purposes of discovery letter briefs governed by this Patent Discovery Order only, the parties may disregard any automatically generated Notice to Filer of Deficiencies invoking Local Rule 11's formatting rules or Local Rule 83-2.11's prohibition on communications with the judge via letter. The moving party shall fully comply with both the letter and the spirit of Local Rule 7-3 and 37-1's meet-and-confer requirements prior to submitting its opening letter brief. The parties are further encouraged to review Federal Rule of Civil Procedure 37(5)(A) carefully before submitting any discovery briefs.

Upon the filing of the opening letter brief, the opposing party shall have 7 days to file a responding letter brief. The parties' opening and responding letter briefs shall not exceed 5 single-spaced pages, excluding declarations and exhibits. Both briefs shall succinctly state each side's position on the dispute. The Court will not accept any reply briefs.

In lieu of holding a hearing on discovery matters, the Court will schedule a teleconference for as soon as practicable following the Court's receipt of the opposing party's responding letter brief.

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

CIVIL MINUTES – GENERAL

No.	SACV 12-1324-ODW(MRWx)	Date	April 1, 2013
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B. Coordination and Limitation on Discovery

The Court intends to actively manage this case in order to conserve the resources of all parties and to focus effort on key issues. The Court notes that the attached case-management schedule assumes one trial. These actions are being coordinated, but the Court will only join Defendants for trial if such consolidation will facilitate the just, speedy, and inexpensive disposition of the actions and the criteria of 35 U.S.C. § 299 are met. A further case-management conference will be held after the Court issues its *Markman* order to re-evaluate these dates as necessary.

The Court will require efficient coordinated discovery practice. The parties shall confer and attempt to agree on limitations that reflect coordination. For example, on common issues, Plaintiff's witnesses should not, in most instances, be separately deposed in every case. Rather, a combined multi-day deposition would be appropriate, scheduled for enough time to cover all Defendants' individual issues, with common issues handled in a coordinated and nonduplicative manner. The Court anticipates that, subject to confidentiality restrictions, all depositions of Plaintiff's witnesses shall be cross-noticed for, and may be used in, every case. The parties are encouraged to cross-notice depositions of defense witnesses where appropriate. The parties should agree on a number of common discovery requests to be served on Plaintiff, with a small number of additional requests for each Defendant. Likewise, the parties should explore whether it would be feasible to reduce the default number of discovery requests to be served on each Defendant.

Defendants are encouraged to coordinate their positions to the maximum extent possible and not present Plaintiff or the Court with multiple proposals on scheduling and coordination of discovery unless there are truly insoluble conflicts among the defendants. Defendants are encouraged to form working groups, perhaps organized by issue, to assist in the coordination of these actions and the presentation of a cohesive Defense position to the extent possible.

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

CIVIL MINUTES – GENERAL

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III. The Cases Against the Retailer Defendants are Hereby Stayed

The Court hereby **GRANTS** the following retailer Defendants' motions to stay:

Digitech Image Tech. LLC v. Buy.com, No. 8:12-cv-01668, ECF No. 13
Digitech Image Tech. LLC v. Best Buy Co., No. 8:12-cv-01669, ECF No. 19
Digitech Image Tech. LLC v. B&H Foto & Elec. Corp., No. 8:12-cv-01671, ECF No. 18
Digitech Image Tech. LLC v. Target Corp., No. 8:12-cv-01683, ECF No. 16
Digitech Image Tech. LLC v. Micro Elec. Inc., No. 8:12-cv-01686, ECF No. 16
Digitech Image Tech. LLC v. Overstock.com, No. 8:12-cv-01687, ECF No. 16
Digitech Image Tech. LLC v. Newegg Inc., No. 8:12-cv-01688, ECF No. 23
Digitech Image Tech. LLC v. CDW LLC, No. 8:12-cv-01695, ECF No. 22

In addition, the retailer Defendants listed above are hereby **ORDERED** to communicate with Christopher Broderick as soon as practicable, but in no event later than April 5, 2013, to inform him whether each retailer will agree to be bound to this Court's *Markman* and invalidity rulings once the stay has been lifted in exchange for a stay of this entire litigation pending final resolution of every manufacturer action. Mr. Broderick shall then email the Court's courtroom deputy clerk, Sheila English, at Sheila_English@cacd.uscourts.gov no later than April 8, 2013, to alert the Court of the retailers' decision. A retailer's refusal to be bound by the Court's *Markman* and invalidity rulings will affect the length of the stay against that retailer Defendant and may result in the Court's immediately lifting the stay.

In addition, Plaintiff and the retailer Defendants shall coordinate one round of sales-figure discovery requests. Plaintiff must then submit these discovery requests for Court approval prior to propounding those requests on the retailer Defendants.

IV. Sakar's Motion to Transfer Venue

Defendant Sakar's Motion to Transfer Venue in *Digitech Image Technologies LLC v. Sakar International Inc.*, No. 8:12-cv-01673, ECF No. 13 (C.D. Cal. filed December 3, 2012) is

Case 8:12-cv-01324-ODW-MRW Document 89 Filed 04/01/13 Page 6 of 7 Page ID #:2785

UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

CIVIL MINUTES – GENERAL

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hereby **DENIED** without prejudice. Defendants Sakar and Leica Camera Inc. may renew their motions to transfer after the Court issues a *Markman* order in this matter.

V. Acacia's and Mamiya's Motions to Dismiss

Counter-Defendant Acacia Research Corporation's Motion to Dismiss filed in *Digitech Image Tech. LLC v. Newegg Inc.*, No. 8:12-cv-01688, ECF No. 30, is hereby taken under submission. An order will issue.

In addition, the April 8, 2013 hearing on Defendant Leaf Imaging Ltd.'s Motion to Dismiss filed in *Digitech Image Tech. LLC v. Mamiya Digital Imaging Co.*, No. 8:12-cv-01688, ECF No. 26, is hereby **VACATED** and no appearances are necessary. The Motion is taken under submission; an order will issue.

VI. Service of This Order

Plaintiff is **ORDERED** to immediately serve a copy of this order on all Defendants who have not yet filed appearances in the cases (and who therefore have not received a copy through the CM/ECF system).

IT IS SO ORDERED.

List of *Digitech* Cases

1. 8:12-cv-01324-ODW-MRW *Digitech v. Electronics for Imaging Inc.*
2. 8:12-cv-01667-ODW-MRW *Digitech v. Panasonic Corp. et al.*
3. 8:12-cv-01668-ODW-MRW *Digitech v. Buy.com*
4. 8:12-cv-01667-ODW-MRW *Digitech v. Best Buy Co.*
5. 8:12-cv-01670-ODW-MRW *Digitech v. Canon Inc. et al.*
6. 8:12-cv-01671-ODW-MRW *Digitech v. B&H Foto & Elec. Corp.*
7. 8:12-cv-01673-ODW-MRW *Digitech v. Sakar Int'l Inc.*

UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

CIVIL MINUTES – GENERAL

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8.	8:12-cv-01675-ODW-MRW	*Digitech v. Mamiya Digital Imaging Co. et al.*
9.	8:12-cv-01676-ODW-MRW	*Digitech v. Olympus Corp. et al.*
10.	8:12-cv-01677-ODW-MRW	*Digitech v. Leica Camera AG et al.*
11.	8:12-cv-01678-ODW-MRW	*Digitech v. Sony Corp. et al.*
12.	8:12-cv-06379-ODW-MRW	*Digitech v. Fujifilm Corp. et al.*
13.	8:12-cv-01680-ODW-MRW	*Digitech v. General Imaging Co.*
14.	8:12-cv-01681-ODW-MRW	*Digitech v. Sigma Corp. et al.*
15.	8:12-cv-01683-ODW-MRW	*Digitech v. Target Corp.*
16.	8:12-cv-01685-ODW-MRW	*Digitech v. Nikon Corp. et al.*
17.	8:12-cv-01686-ODW-MRW	*Digitech v. Micro Elec. Inc.*
18.	8:12-cv-01687-ODW-MRW	*Digitech v. Overstock.com*
19.	8:12-cv-01688-ODW-MRW	*Digitech v. Newegg Inc.*
20.	8:12-cv-01689-ODW-MRW	*Digitech v. Pentax Ricoh Imaging et al.*
21.	8:12-cv-01693-ODW-MRW	*Digitech v. Xerox Co.*
22.	8:12-cv-01694-ODW-MRW	*Digitech v. Konica Minolta Holdings Inc. et al.*
23.	8:12-cv-01695-ODW-MRW	*Digitech v. CDW LLC*
24.	8:12-cv-01686-ODW-MRW	*Digitech v. Victor Hasselblad AB et al.*
25.	8:12-cv-01697-ODW-MRW	*Digitech v. Casio Computer Co. et al.*
26.	8:12-cv-02122-ODW-MRW	*Digitech v. Asus Computer Int'l et al.*
27.	8:12-cv-02123-ODW-MRW	*Digitech v. Motorola Mobility Inc. et al.*
28.	8:12-cv-02125-ODW-MRW	*Digitech v. Apple Inc.*
29.	8:12-cv-02126-ODW-MRW	*Digitech v. Acer America Corp. et al.*
30.	8:12-cv-02127-ODW-MRW	*Digitech v. Toshiba Corp. et al.*
31.	8:13-cv-00134-ODW-MRW	*Digitech v. LG Electronics USA et al.*
32.	8:13-cv-00135-ODW-MRW	*Digitech v. HTC America Inc. et al.*

CHRISTOPHER P. BRODERICK
cbroderick@orrick.com
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: 213-629-2020
Facsimile: 213-612-2499

Attorneys for Defendants

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

WESTERN DIVISION

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) **REPLY IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) **REPLY IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION and SIGMA CORPORATION OF AMERICA, Defendants.	CASE NO. SACV 12-01681-ODW (MRWx) **REPLY IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01689-ODW (MRWx) **REPLY IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01694-ODW (MRWx) **REPLY IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

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PRELIMINARY STATEMENT

Digitech's Opposition actually confirms that summary judgment should be granted. Digitech did not (1) dispute a single Uncontroverted Fact Supporting Summary Judgment (UF), (2) assert that any UFs are immaterial, or (3) identify any facts in support of its alleged Genuine Issues. It further admitted that (1) every asserted claim is directed to a "device profile," and (2) a device profile consists of data. Those uncontested facts alone require a summary judgment of invalidity.

Rather than responding to the arguments and substantial precedent in the moving papers, Digitech resorts to smoke and mirrors. But the Court can and should reject Digitech's efforts to manufacture factual disputes based on: (1) citations to portions of the specification directed to <u>un</u>asserted claims; (2) a novel interpretation that the asserted claims read on every device in a digital imaging system and every image (contradicting the discovery responses Digitech provided less than a month ago); (3) unsupported allegations regarding the use of a device profile that are unrelated to the §101 analysis; and (4) conclusory statements made by an unqualified declarant.

Moreover, the Opposition abandons positions taken by Digitech in its June 24, 2013 letter to the Court. In particular, it does not assert that the claim term "device profile" requires construction, in contrast with its June 24 Letter, or propose a construction for that term, pursuant to the Court's Order. Instead, Digitech desperately attempts to avoid summary judgment by sidestepping the proper framework for analyzing invalidity under §101.

Under that analytical framework, as set forth in Defendants' MSJ, the asserted claims cannot overcome even the initial hurdle to qualify as one of the four enumerated categories of §101. The Opposition picks and chooses sound bites from a few select cases, while ignoring the overwhelming legal precedent against it. But, tellingly, Digitech ignores the actual application of those sound bite principles, and the holdings of the cases it cites, finding claims invalid under §101.

Digitech also cannot avoid a ruling that the claims are invalid as abstract. Digitech does not dispute that the asserted claims use the mathematical formulas cited in Defendants' moving papers or that the claims are directed to data or data gathering. Digitech's overbroad assertions regarding the coverage of the asserted claims—the device profile can be in any device or even attached to an image leaving or entering any one of those devices—dooms the claims. It is exactly this type of boundless assertion which the Supreme Court uses as a touchstone to hold claims invalid under §101.[1]

I. DIGITECH IGNORES THE PROPER ANALYTICAL FRAMEWORK.

"The first question is whether the claimed invention fits within one of the four statutory classes set out in §101."[2] If the Court determines that Digitech's patent claims do not fall within one of those categories, the claims are invalid. Abstractness is addressed only as a second analytical step, and only if the Court determines that Digitech's claims fall within one of the four categories. Digitech's Opposition buries the first analytical step. As outlined in the MSJ, all the asserted claims are directed to data or data gathering, which is not within one of the four patent eligible categories.[3] Since the asserted claims do not satisfy even the first analytical step of §101, the claims are not patent eligible.

II. DIGITECH IGNORES THE CLEAR CLAIM LANGUAGE.

A. The Asserted Claims On Their Face Are Directed Merely to Data and Data Gathering.

Digitech's Opposition studiously avoids the plain language of the asserted claims, which demonstrates that they are directed to a device profile that consists of data and nothing more. The asserted claims do not recite any structure—no

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[1] *See e.g.*, *Parker v. Flook*, 437 U.S. 584, 586 (1978).

[2] *CLS Bank Int'l v. Alice Corp.*, 106 U.S.P.Q.2d 1969, 1703 (Fed. Cir. 2013) (en banc).

[3] *See In re Grams*, 888 F.2d 835 (Fed. Cir. 1989); *Dealertrack, Inc. v. Huber*, 674 F.3d 1315 (Fed. Cir. 2012); *CyberSource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366 (Fed. Cir. 2011); *Bancorp Serv. v. Sun Life Assurance Co.*, 687 F.3d 1266 (Fed. Cir. 2012). The Opposition fails to address the holdings of these cases that "data" and "data gathering" are not patent eligible.

processor, no computer, no input or output device, no controller, etc.

B. Digitech's Attempt to Import Physical Structure From the Specification into the Claims is Improper and Misleading.

Digitech's focus on the structure recited in the specification is misleading because that discussion is directed to unasserted claims. Digitech is not asserting claims 18-25, and for good reason, as those claims suffer from other defects. But it is noteworthy that Claims 18-25 all start with the phrase "A digital image processing system…." Such a system consists of a collection of physical tangible components such those identified by Digitech. In contrast, the asserted claims all start with "A device profile…" or "A method of generating a device profile…."

Thus, the portions of the '415 patent specification that discuss the "digital imaging processing system" as the invention, and the physical components of such a system (processor, computer, input device, output device, controller, characteristic processing section, image processing section, Fig 1, Fig 2, etc.),[4] are directed to claims 18-25, not the asserted claims. Digitech's improper attempt to import physical structural limitations from the specification into the asserted claims, through unasserted claims 18-25, infects and undermines the entire Opposition.

C. Digitech's New Allegations Regarding Specification Support for Device Profile Contradict its Prior Discovery Responses.

Digitech's discovery responses, which were served after Digitech and the Defendants met and conferred on the §101 motion, did not assert that the device profile of the claims contained any physical limitations.[5] Only two of the assertions

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[4] *See* Digitech's Opp. at 6-8.

[5] Compare the support cited in Digitech's Opposition at Section II.C., 6-8, to Plaintiff Digitech Image Technologies, LLC's Responses to Defendants First Set of Common Interrogatories (Nos. 1-5), served June 7, 2013, attached as Exhibit 1 to the Declaration of Andrew Yen in Support of Defendants' Reply on Motion for Summary Judgment of Invalidity of U.S. Patent No. 6,128,415 Under 35 U.S.C. §101 ("Yen II Decl."), shown below with the common alleged support underlined:

in the Opposition match assertions in Digitech's discovery responses. Digitech's discovery responses nowhere include any discussion of processors, computers, input devices, output devices, controllers, or any of the other physical structural components cited in Digitech's Opposition.

III. A "DEVICE PROFILE" DOES NOT FALL WITHIN ONE OF THE §101 PATENT ELIGIBLE SUBJECT CATEGORIES

A. A Device Profile is Not a Machine.

Digitech's contention that the device profile is a machine rests on an improper attempt to import into the asserted claims structural limitations derived from the specification's discussion of unasserted claims. (Opp. at 19.) In addition, Digitech's position is refuted by its assertion that the "device profile" can be "appended to or embedded in a digital image." *Id.* A machine cannot be embedded in a digital image.

B. A Device Profile is Not a Composition of Matter.

Digitech's Opposition asserts that a device profile is a composition of matter. (Opp. at 20.) Composition of matter claims are directed to items such as hydrocarbons, microorganism, molecules, and motor oil.[6] Although there are numerous cases cited in the moving papers considering claims directed to data, none of them analyzes those claims as a "composition of matter."

C. A Device Profile is Not a Manufacture.

Although the title of Section II.F. of Digitech's Opposition alleges that the device profile is a manufacture, there is no argument to support that contention. A

Digitech's Discovery Responses	Digitech's Opposition to this Motion
Abstract; 1:6-11; 1:64-2:1; 2:7-9; 2:13-16; 2:16-18; 2:18-22; 2:22-26; 2:26-28; 5:11-12	1:19-23; 1:36-40; 1:64-2:1; 2:4-7; 2:4-9; 2:18-22; 2:36-37; 3:32-33; 3:33-35; 3:35-40; 3:41-44; 5:11-15; Fig. 1; Fig. 2

A color markup of the '415 patent specification showing these differences is attached as Exhibit 2 to the Yen II Decl.

[6] *Diamond v. Chakrabarty*, 447 US 303, 305 (1980), *citing Shell Development Co. v. Watson*, 149 F. Supp. 279, 280 (D. D.C. 1957).

device profile is not a manufacturer for at least the reasons stated in the MSJ at 8.

IV. EVEN IF THE CLAIMS INCLUDED A TAG, THEY ARE STILL PATENT INELIGIBLE BECAUSE A TAG IS MERELY DATA.

Digitech's Opposition incorrectly asserts that the device profile should be interpreted to include "a 'tag' appended to or embedded in a digital image obtained using a digital image processing system."[7] Digitech's cited support for this proposition clearly states that the tag "accompanies the digital imaging device,"[8] e.g., the camera, not the digital image. Moreover, even if the data of the device profile included a tag, the claims would still be invalid under §101. A tag is merely another piece of data and data is not patent eligible. A tag is not tangible physical structure that brings the claims within §101.

The references Digitech cites for the meaning of a tag support the conclusion that a tag is data.[9] Digitech's references describe a tag as "one or more characters within or attached to a set of data." Characters are just data. There is ample intrinsic evidence to support a "tag" being data. For example, the ICC profile uses the term "tag data" numerous times.[10]

V. THE DEVICE PROFILE GENERATING CLAIMS DO NOT FALL WITHIN THE FOUR ENUMERATED §101 CATEGORIES.

Digitech's assertion that because the Device Profile Generating Claims start with "A method…" they automatically qualify as a "process" under §101 is refuted by *Bilski II.* The *Bilski II* claims also started with the phrase "A method…."[11] The

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[7] Opp. at 6, ln. 10, 8, ln. 5, 9, ln. 3, 19, ln. 17.

[8] Opp. at 8, ln. 10.

[9] The Opposition cites two unqualified sources for the meaning of a "tag." Opp. at 8, fn. 3. The first is an IEEE dictionary from 2000. The priority date of the patent is September 6, 1996. There is no showing that the meaning of "tag" in this 2000 reference is the same as the meaning of "tag" at the time of invention. The second is referred to only as "Ex. 6," with no indication as to the title, year, author, or source. Neither reference is attached to the Opposition or referenced in or attached to any supporting declaration.

[10] See the ICC Specification in the prosecution history, attached as Exhibit B to the Yen Decl. supporting the moving papers, at 200, 217, 218, 224, 225 and 288.

[11] *In re Bilski*, 545 F.3d 943, 949 (Fed. Cir. 2008) ("*Bilski I*").

Supreme Court specifically held that the machine or transformation test can be used to determine if a claim starting with the phrase "A method" qualifies as a "process," and thus is within the enumerated "process" category under §101.[12]

> "This Court's precedents establish that the machine-or-transformation test is a useful and important clue, an investigative tool, for determining whether some claimed inventions are processes under §101."

Defendants' moving papers followed *Bilski II* by applying the machine or transformation test to determine if the Device Profile Generating Claims qualify as a process. As explained therein, because the Device Profile Generating Claims fail the machine or transformation test, they are not patent eligible. *Bilski II* noted that the machine or transformation test may not be the sole test for §101 eligibility for some new technologies, such as business methods and Internet patents.[13] The '415 patent is not one of these new technologies. The '415 patent is directed to device profiles used in digital imaging systems such as cameras. Device profiles and cameras have been around for a long time and the machine or transformation test is an appropriate test for the '415 patent.

VI. EVEN IF THE ASSERTED CLAIMS WERE WITHIN ONE OF THE §101 CATEGORIES, THEY STILL WOULD BE AN UNPATENTABLE ABSTRACT IDEA.

Digitech's Opposition ignores the substantial intrinsic evidence offered in Defendants' moving papers that the asserted claims cover an unpatentable abstract idea, including the following:

- Characteristic functions are merely mathematical functions $M(u,v)=<M(x,y,u,v)>_{xy}$ (MSJ at 9-10, UF 10.)
- The first data is generated through use of measured chromatic stimuli and device response characteristic functions. (MSJ at 10-11.)

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[12] *Bilski v. Kappos*, 130 S. Ct. 3218, 3227 (2010) ("*Bilski II*").
[13] *Id*. at 3227.

- The second data is generated through spatial stimuli and device response characteristic functions. (MSJ at 10-11.)
- The claim phrases:

  "for describing a device dependent transformation of color information content of the image to a device independent color space…"; and

  "for describing a device dependent transformation of spatial information content of the image in said device independent color space…",

  merely describe the content of the data and indicate the pre-existing data and mathematical relationships that describe the data. (MSJ at 12-13.)
- The named inventors expressly admitted to the PTO that the claimed device profile was an "abstract description." (MSJ at 2, UF 14.)

VII. DIGITECH'S UNSUPPORTED ASSERTIONS DO NOT MAKE THE ASSERTED CLAIMS PATENT ELIGIBLE.

None of Digitech's unsupported assertions renders the claims patent eligible:

- Digitech's claims regarding the importance of a device profile are irrelevant to patentability. The Supreme Court held that "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the §101 inquiry."[14]
- There is no legal support for Digitech's bald assertion that any claim that uses the transitional word "comprising" satisfies §101.[15] Every Supreme Court case cited in the moving papers (*Bilski*, *Chakrabarty*, *Diehr*, *Benson*, *Flook*), and many of the Federal Circuit cases, analyzed a claim using a form of "comprising" as its transitional phrase. Digitech's argument was not considered in any of those cases, Defendants know of no case that endorses such an approach, and Digitech's Opposition cites no such case.
- Digitech is wrong in asserting that a person cannot calculate a transformation into device independent color space or perform the calculation on paper.

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[14] *Association for Molecular Pathology, et al., v. Myriad Genetics, Inc. et al.*, 569 US ____, 133 S.Ct. 2107, 2117 (2013).

[15] Taking Digitech's argument to its logical conclusion, the claim: "A device profile, consisting of: data" would satisfy §101, contrary to all of the precedent cited in the MSJ.

This assertion is easily refuted by considering the examples of r,g,b color space in the MSJ at fn. 11, p. 4, along with the equation on page 9.[16]

- Digitech's assertion that the claims contain meaningful limitations is wrong. The claims do not contain meaningful limitations because they do not satisfy the machine or transformation test.[17]
- Digitech errs in asserting that whether a claim preempts an idea is coextensive with the question of abstractness. For example, the Supreme Court in *Flook* held that, "although the claim would not 'wholly preempt' the mathematical formula, the claimed process nonetheless fell under the abstract ideas exception to patent eligibility."[18]
- Digitech errs in asserting that whether a claim contains insignificant or token pre- or post-solution activity defines the test for abstractness. It is well-established that adding insignificant pre- or post-solution activity will not cure abstractness or invalidity under §101.[19]

VIII. DIGITECH IGNORES SUBSTANTIAL LEGAL PRECEDENT.

Digitech's Opposition fails to meaningfully address any of the following significant precedents discussed in Defendants' moving papers:

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[16] Pure red has the r,g,b triplet 255,0,0. Using these values with the transformation equation yields an X,Y,Z triplet of 706,255,0. [X=706 (=2.769*255), Y=255 (=1.000*255), Z=5.593*0] Pure black is 0,0,0 in r,g,b, which, using the equation below, is also 0,0,0 in X, Y, Z.

Transformation Equation	Convert pure red from r,g,b=255,0,0 to X,Y,Z
$X = 2.769R + 1.752G + 1.130B$	X = 2.769*255 + 1.752*0 + 1.130*0
$Y = 1.000R + 4.591G + 0.060B$	Y = 1.000*255 + 4.591*0 + 0.060*0
$Z = 0.000R + 0.057G + 5.593B$	Z = 0.000*255 + 0.057*0 + 5.593*0

[17] *See CLS*, 106 U.S.P.Q.2d at 1718, *citing Bilski II*, 130 S. Ct. at 3227 ("A claim is meaningfully limited if it requires a particular machine implementing a process or a particular transformation of matter.")

[18] *Id.*, *citing Flook*, 437 U.S. at 589 (*CLS* and *Flook* found claims invalid under §101.)

[19] *See Bilski II*, 130 S. Ct. at 3230 ("[T]he prohibition against patenting abstract ideas 'cannot be circumvented by attempting to limit the use of the formula to a particular technological environment' or adding 'insignificant postsolution activity.'")

- *Bancorp* (holding invalid claims that "do not transform the raw data into anything other than more data and are not representations of any physically existing objects");
- *CyberSource* (holding invalid claims directed to "[t]he mere manipulation or reorganization of data");
- *Benson* (holding invalid claims directed to converting existing data (i.e., binary-coded decimal numbers) to a different data format (i.e., pure binary) through use of an algorithm);
- *Flook* (holding invalid a method claim directed to gathering data and manipulating data using a mathematical formula);
- *Grams* (holding invalid method claims directed to gathering and analyzing data using a mathematical algorithm);
- *Warmerdam* (holding invalid claims for a data structure and generating a data structure); and
- *Accenture* (holding invalid claims directed to generating and organizing data.).

IX. THERE ARE NO FACTUAL DISPUTES THAT WOULD PRECLUDE ENTRY OF SUMMARY JUDGMENT.

Digitech cites four cases for the general proposition that factual disputes may preclude a pre-trial determination of §101 issues (Opp. at 2-3), but not one of those cases involved a denial of summary judgment because of factual disputes.[20] Here,

[20] *In re Comiskey*, 554 F.3d 967, 973 (Fed. Cir. 2009) (en banc) (claims held invalid under §101 where there were no factual issues); *Arrhythmia Research Tech., Inc. v. Corazonix Corp.*, 958 F.2d 1053, 1056 (Fed. Cir. 1992) (although "determination of this question may require findings of underlying facts specific to the particular subject matter and its mode of claiming, in this case there were no disputed facts material to the issue."); *Insured Deposits Conduit, LLC v. Index Powered Fin. Servs., LLC*, No. 07-22735-CIV, 2008 WL 5691348, at *1-2 (S.D. Fla. Feb. 26, 2008) (*See* Order dated February 26, 2008 instead of March 14, 2008 Order cited by Digitech, denying SJ on noninfringement on long complicated claims, all over 530 words, while the instant independent claims are a mere 69 words.); *Ultramercial, Inc. v. Hulu, LLC*, No. 2010-1544, 2013 WL 3111303, at *3 (Fed. Cir. June 21, 2013) (affirming §101 ruling

there are no factual disputes supporting a denial of summary judgment. The asserted claims are short and easy to understand. They are directed to a simple element, a device profile, consisting entirely of data. And, since the '415 claims do not fall within one of the four §101 categories, the analysis does not need to proceed to the next step of whether the claims cover mere abstract ideas.

Digitech's conclusory claim of disputed factual issues is undermined by its failure to controvert any of Defendants' Uncontested Facts and its failure to supply any support for its statement of Genuine Issues.

X. THE DECLARATION OF JOHN CANNIZZO DOES NOT RAISE FACTUAL ISSUES PRECLUDING SUMMARY JUDGMENT AND SHOULD BE STRICKEN UNDER FRE 702 AND FRCP 56.

The Court should strike the Cannizzo Declaration because: (1) Cannizzo fails to demonstrate his expert qualifications or knowledge with respect to the subject matter of his declaration; and (2) Cannizzo's testimony is entirely conclusory.

First, the prosecution history provides a specific list of qualifications and knowledge that a person of ordinary skill in the art (POSITA) must possess. Cannizzo short-cites this passage leaving out the critical knowledge required for a POSITA. (Cannizzo Decl. ¶ 4.) (POSITA must be "familiar with color science as taught in volumes such as Hunt and Stiles and Wyszecki" and "the concepts of spatial micro image structure and processing as taught in Dainty and Shaw and Castleman"). Cannizzo does not assert that he is familiar with color science at all, much less the specific color science references and concepts that the inventors described as the required basic knowledge of a POSITA.

Cannizzo's education demonstrates he is not a POSITA. He has bachelor's degrees in computer science and biology—not color science, and his PhD in biochemistry indicates that the major thrust of his experience is not in the field of

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granting a Rule 12(b)(6) motion on a claim that contained 11 limitations and was computer implemented, which the moving papers noted is often more complicated to analyze).

color science. Nor does Cannizzo's work history establish his credentials as POSITA. His declaration focuses on his work related to his biology and biochemistry background in the medical field. His only relevant experience was working at Konica Minolta, but that experience did not even start until after 1996. Not only does a person have to be qualified to offer opinion testimony (which Cannizzo is not), he or she has to be qualified to opine on the understanding of a POSITA at the critical time—here, September of 1996, the filing date of the patent. Cannizzo's general work experience in digital image processing does not qualify him as a practitioner of image science as defined by the inventors. Although Cannizzo's declaration contains a long and diverse list of technical specialties, including some work related to digital imaging, there is not a single mention of work on a "device profile."[21] For these reasons, all of Cannizzo's statements characterizing the understanding of a POSITA, ¶¶ 4-8, 10-11, 13-15, 19-38, should be excluded as lacking foundation under FRE 702.

Second, Cannizzo's declaration is full of "[c]onclusory expert assertions [that] cannot raise triable issues of material fact on summary judgment."[22] Below are representative examples of Cannizzo's unsupported and conclusory statements:

- One of ordinary skill in the art would understand that many of the characterizations of the device profiles are done "on the fly", such as white balance. Cannizzo Decl. ¶ 20.
- A manual process for calculating characterizations, even if theoretically possible, would be entirely impractical and unacceptable at least because this calculation speed is an important factor in making a digital imaging system possible. Cannizzo Decl. ¶ 22.

If the Cannizzo Declaration is considered at all, all of his conclusory statements,

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[21] *See Flex-Rest, LLC v. Steelcase, Inc.*, 455 F.3d 1351, 1360-61 (Fed. Cir. 2006) (affirmed exclusion of an ergonomics expert where the patent related to an ergonomic keyboard design.)

[22] *See Sitrick v. Dreamworks*, 516 F.3d 993, 1001 (Fed. Cir. 2008), *citing Dynacore Holdings Corp. v. U.S. Philips Corp.*, 363 F.3d 1263, 1278 (Fed. Cir. 2004).

including those in paragraphs 5-8, 10-11, 13-15, 19-38, should be excluded under FRCP 56 and FRE 702.

XI. CONCLUSION

For the reasons set forth herein, the Court should grant Defendants' motion for summary judgment and hold that the asserted claims are invalid because they are directed to non-statutory subject matter under 35 U.S.C. §101.

Dated: July 17, 2013 Orrick, Herrington & Sutcliffe LLP

By: /s/ *CHRISTOPHER P. BRODERICK*
CHRISTOPHER P. BRODERICK

Attorneys for Defendants

FUJIFILM Corporation, Sigma Corporation and Sigma Corporation of America, Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., and Ricoh Americas Corp., Konica Minolta Business Solutions, U.S.A., Inc.

CHRISTOPHER P. BRODERICK
cbroderick@orrick.com
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: 213-629-2020
Facsimile: 213-612-2499

Attorneys for Defendants

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) **DEFENDANTS' RESPONSE TO DIGITECH'S UNSUPPORTED STATEMENT OF GENUINE ISSUES OF MATERIAL FACT** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) **DEFENDANTS' RESPONSE TO DIGITECH'S UNSUPPORTED STATEMENT OF GENUINE ISSUES OF MATERIAL FACT** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION and SIGMA CORPORATION OF AMERICA, Defendants.	CASE NO. SACV 12-01681-ODW (MRWx) **DEFENDANTS' RESPONSE TO DIGITECH'S UNSUPPORTED STATEMENT OF GENUINE ISSUES OF MATERIAL FACT** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01689-ODW (MRWx) **DEFENDANTS' RESPONSE TO DIGITECH'S UNSUPPORTED STATEMENT OF GENUINE ISSUES OF MATERIAL FACT** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01694-ODW (MRWx) **DEFENDANTS' RESPONSE TO DIGITECH'S UNSUPPORTED STATEMENT OF GENUINE ISSUES OF MATERIAL FACT** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

Pursuant to Federal Rule of Civil Procedure 56 and Local Rule 56-2, Defendants FUJIFILM Corporation, Sigma Corporation, Sigma Corporation of America, Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., Ricoh Americas Corp., and Konica Minolta Business Solutions, U.S.A., Inc., (collectively "Defendants"), submit the following DEFENDANTS' RESPONSE TO DIGITECH'S UNSUPPORTED STATEMENT OF GENUINE ISSUES OF MATERIAL FACT

Dated: July 17, 2013

Orrick, Herrington & Sutcliffe LLP

By: */s/ Christopher P. Broderick*
CHRISTOPHER P. BRODERICK

Attorney for Defendants

FUJIFILM Corporation, Sigma Corporation, Sigma Corporation of America, Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., Ricoh Americas Corp. and Konica Minolta Business Solutions, U.S.A., Inc.

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
1. There is a genuine factual dispute over whether claims 1-6, 9-15 and 27-31 (the "Asserted Claims) of U.S. Patent No. 6,128,415 (the "'415 patent"), as a whole, claim or merely entail or describe an abstract idea.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." In addition, the "dispute" identified by Digitech does not relate to an issue of fact but is instead a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. The legal conclusion of whether the claims are abstract is disputed. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the asserted claims cover an "abstract idea."
2. There is a genuine factual dispute over whether the "device profile" of the Asserted Claims of the '415 patent is or merely entails or describes an abstract idea.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." In addition, the "dispute" identified by Digitech does not relate to an issue of fact but is instead a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. The legal conclusion of whether the claims are abstract is disputed. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the asserted claims cover an "abstract idea."
3. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent claim contain limitations that meaningfully tie any alleged abstract idea to an actual application of that idea through meaningful limitations.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." In addition, the "dispute" identified by Digitech does not relate to an issue of fact but is instead a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. The asserted claims do not contain meaningful limitations because they

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		do not satisfy the machine or transformation test. As the Federal Circuit recently recognized, the "Supreme Court has told us when a claim likely should not be deemed meaningfully limited, it has also given us examples of meaningful limitations which likely remove claims from the scope of the Court's judicially created exceptions to Section 101. Thus, a claim is meaningfully limited if it requires a particular machine implementing a process or a particular transformation of matter. *See Bilski*, 130 S. Ct. at 3227" *CLS Bank Int'l v. Alice Corp.*, 106 U.S.P.Q.2d 1969, 1718 (Fed.Cir. 2013)(en banc). See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101.

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims contain limitations that meaningfully tie any alleged abstract idea to an actual application of that idea through meaningful limitations.
4. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent claim cover all practical applications of (i.e., pre-empt) an abstract idea.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." In addition, the "dispute" identified by Digitech does not relate to an issue of fact but is instead a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. Whether a claim preempts an idea is not coextensive with the question of abstractness and it does not define the test for abstractness or the test for invalidity under §101. If a claim has these characteristics, then it is abstract and invalid under §101. If a claim does not have these characteristics, it can still be abstract, and even if not

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		abstract it can be invalid under §101. For example, the Supreme Court in *Flook* held that although the claim would not 'wholly preempt' the mathematical formula, the Court nonetheless held that the claimed process fell under the abstract ideas exception to patent eligibility." *CLS Bank Int'l v. Alice Corp.*, 106 U.S.P.Q.2d 1969, 1699, (Fed.Cir. 2013)(en banc), *citing Parker v. Flook*, 437 U.S. 584, 589 (1978) (CLS and *Flook* found the claims invalid under §101.) See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		patent is invalid as invalidity under Section 101 does not depend solely on whether the claims cover all practical applications of (i.e., pre-empt) an abstract idea.
5. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent contain only insignificant or token pre- or post-solution activity.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." In addition, the "dispute" identified by Digitech does not relate to an issue of fact but is instead a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. Whether a claim contains only insignificant or token pre- or post-solution activity does not define the test for abstractness or the test for invalidity under §101. If a claim has these characteristics, then it is abstract and invalid under §101. If a claim does not have these characteristics, it can still be abstract, and even if not abstract it can be invalid under §101. "[T]he cases repeatedly caution against overly formalistic approaches to subject-matter eligibility that invite manipulation by patent applicants.

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		Allowing the determination of patent eligibility to 'depend simply on the draftsman's art . . . would ill serve the principles underlying the prohibition against patents for \`ideas' or phenomena of nature.' *Flook*, 437 U.S. at 593. Thus, claim drafting strategies that attempt to circumvent the basic exceptions to § 101 using, for example, highly stylized language, hollow field-of-use limitations, or the recitation of token post-solution activity should not be credited. *See Bilski*, 130 S. Ct. at 3230 ('[T]he prohibition against patenting abstract ideas \`cannot be circumvented by attempting to limit the use of the formula to a particular technological environment' or adding \`insignificant postsolution activity.'' *(quoting Diehr*, 450 U.S. at 191-92)); *Flook*, 437 U.S. at 590 (rejecting such an approach as 'exalt[ing] form over substance')." *CLS Bank Int'l v. Alice Corp.*, 106 U.S.P.Q.2d 1969, 1703, (Fed.Cir. 2013)(en banc). See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101.

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the asserted claims include insignificant or token pre- or post-solution activity.
6. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent provide real direction, cover all possible ways to achieve the provided result, or are overly-generalized.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." In addition, the "dispute" identified by Digitech does not relate to an issue of fact but is instead a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. Whether "a claim is not meaningfully limited if its purported limitations provide no real direction, cover all

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		possible ways to achieve the provided result, or are overly-generalized" does not define the test for abstractness or the test for invalidity under §101. If a claim has these characteristics then it is abstract and invalid under §101. If a claim does not have these characteristics it can still be abstract and even if not abstract it can be invalid under §101. "Finally, the Supreme Court has stated that a claim is not meaningfully limited if its purported limitations provide no real direction, cover all possible ways to achieve the provided result, or are overly-generalized. *See Prometheus*, 132 S. Ct. at 1300 ('[S]imply appending conventional steps, specified at a high level of generality, to laws of nature, natural phenomena, and abstract ideas cannot make those laws, phenomena, and ideas patentable.')." *CLS Bank Int'l v. Alice Corp.*, 106 U.S.P.Q.2d 1969, 1703, (Fed.Cir. 2013)(en banc). See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the asserted claims provide real direction, cover all possible ways to achieve the provided result, or are overly-generalized.
7. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent tie an allegedly abstract idea to a specific way of doing something with a computer, or a specific computer for doing something.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." In addition, the "dispute" identified by Digitech does not relate to an issue of fact but is instead a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. The asserted fact/issue is irrelevant since it is directed to the use and implementation of a device profile,

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		and not the limitations set forth in the claim language. Even if the claims included a computer it would not make the claims patent eligible under §101. *See*, *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333-34 (a claim directed to a computer aided method of managing credit application invalid under 101 because "simply adding a 'computer aided' limitation to a claim covering an abstract concept, without more, is insufficient to render the claim patent eligible.") and *CyberSource Corp. v. Retail Decisions Inc.*, 654 F.3d 1366, 1373-74 (a claim directed to a computer readable medium containing program instructions that can be executed by one or more processors of a computer to be invalid under 101 because it is drawn to an abstract idea). In addition, the Supreme Court made it clear that "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the §101 inquiry." *Association for Molecular Pathology, et al., v. Myriad Genetics, Inc. et al.*, 569 US ____, No. 12-398, Supreme Court, June 13, 2013. The asserted claims are not tied to a computer or a specific computer for doing something. The asserted claims do not contain a

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		computer or any physical limitation tied to a computer. Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a computer. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the asserted claims tie an abstract idea to a specific way of doing something with a computer, or a specific computer for doing

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		something.
8. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent entail a computer being part of the solution, being integral to the performance of the method, or containing an improvement in computer technology.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." The asserted fact/issue is irrelevant since it is directed to the use and implementation of a device profile, and not the limitations set forth in the claim language. In addition, the Supreme Court made it clear that "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the §101 inquiry." *Association for Molecular Pathology, et al., v. Myriad Genetics, Inc. et al.*, 569 US ____, No. 12-398, Supreme Court, June 13, 2013. The asserted claims are not tied to a computer or a specific computer for doing something. The asserted claims do not contain a computer or any physical limitation tied to a computer. Even if the claims included a computer it would not make the claims patent eligible under §101. *See, Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333-34 (a claim directed to a computer aided method of managing credit application invalid under 101 because "simply adding a

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		'computer aided' limitation to a claim covering an abstract concept, without more, is insufficient to render the claim patent eligible.") and *CyberSource Corp. v. Retail Decisions Inc.*, 654 F.3d 1366, 1373-74 (a claim directed to a computer readable medium containing program instructions that can be executed by one or more processors of a computer to be invalid under 101 because it is drawn to an abstract idea). Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a computer. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		"factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether a computer is part of the solution, being integral to the performance of the method, or containing an improvement in computer technology.
9. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent comprise inventions with specific applications or improvements to technologies in the marketplace.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech cites no support for this issue/fact. It is also irrelevant since it is directed to the use and implementation of a device profile, and not the limitations set forth in the claim language. In addition, the Supreme Court made it clear that "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the §101 inquiry." *Association for Molecular Pathology, et al., v. Myriad Genetics, Inc. et al.*, 569 US ____, No. 12-398, Supreme Court, June 13, 2013. There is no evidence that the asserted claims comprise inventions with specific applications or improvements in the marketplace. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims comprise inventions with specific applications or improvements to technologies in the marketplace.
10. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent comprise functional and palpable applications in the field of computer imaging technology.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." In addition, the "dispute" identified by Digitech does not relate to an issue of fact but is instead a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		asserted claims fall within one of the four enumerated categories of §101, which they do not. The asserted fact/issue is irrelevant since it is directed to the use and implementation of a device profile, and not the limitations set forth in the claim language. The Supreme Court made it clear that "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the §101 inquiry." *Association for Molecular Pathology, et al., v. Myriad Genetics, Inc. et al.*, 569 US ____, No. 12-398, Supreme Court, June 13, 2013. There is no evidence that the asserted claims are tied to a computer or a specific computer for doing something. The asserted claims do not contain a computer or any physical limitation tied to a computer. Even if the claims included a computer it would not make the claims patent eligible under §101. *See*, *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333-34 (a claim directed to a computer aided method of managing credit application invalid under 101 because "simply adding a 'computer aided' limitation to a claim covering an abstract concept, without

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		more, is insufficient to render the claim patent eligible.") and *CyberSource Corp. v. Retail Decisions Inc.*, 654 F.3d 1366, 1373-74 (a claim directed to a computer readable medium containing program instructions that can be executed by one or more processors of a computer to be invalid under 101 because it is drawn to an abstract idea). Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a computer. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims comprise functional and palpable applications in the field of computer imaging technology.
11. There is a genuine factual dispute over whether the "device profile" in the Asserted Claims of the '415 patent tangibly exists as an integral part of the design and calibration of a processor device within a digital image processing system.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This is not a fact. It is a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. The asserted fact/issue is irrelevant since it is directed to the use and implementation of a device profile, and not the limitations set forth in the claim language. There is no evidence that the asserted claims are part of a processor device or exist as an integral part of the design and calibration of a processor device. The asserted claims do not contain a processor or any physical limitation tied to a processor.

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		Even if the claims included a computer and/or processor it would not make the claims patent eligible under §101. *See, Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333-34 (a claim directed to a computer aided method of managing credit application invalid under 101 because "simply adding a 'computer aided' limitation to a claim covering an abstract concept, without more, is insufficient to render the claim patent eligible.") and *CyberSource Corp. v. Retail Decisions Inc.*, 654 F.3d 1366, 1373-74 (a claim directed to a computer readable medium containing program instructions that can be executed by one or more processors of a computer to be invalid under 101 because it is drawn to an abstract idea). Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a computer. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims exist as an integral part of the design and calibration of a processor device within a digital image processing system.
12. There is a genuine factual dispute over whether the "device profile" in the Asserted Claims of the '415 patent tangibly exists as a "tag" appended to or embedded in a digital image obtained using a digital image processing system.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. The asserted fact/issue is irrelevant since it is directed to the use and implementation of a device profile, and not the limitations set forth in the claim language. Even if the claims included a digital image processing system it would not

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		make the claims patent eligible under §101. *See, Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333-34 (a claim directed to a computer aided method of managing credit application invalid under 101 because "simply adding a 'computer aided' limitation to a claim covering an abstract concept, without more, is insufficient to render the claim patent eligible.") and *CyberSource Corp. v. Retail Decisions Inc*., 654 F.3d 1366, 1373-74 (a claim directed to a computer readable medium containing program instructions that can be executed by one or more processors of a computer to be invalid under 101 because it is drawn to an abstract idea). Further, it is irrelevant whether the device profile contains a "tag." A tag is just data. Adding more data to the device profile claims will not and cannot make the claim fall within one of the four enumerated categories of §101 or cure a claim of abstractness. There is no evidence that the claims exist as a tag appended to embedded in a digital image obtained using a digital image processing system. Even if the claims included a tag it would not make them patent eligible. *See In re Warmerdam*, 33 F.3d 1354 (Fed. Cir. 1994) (claims directed to data structure and methods for generating data structure are found to

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		be abstract and not patent eligible under §101.) See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims exists as a tag appended to or embedded in a digital image obtained using a digital image processing system.
13. There is a genuine factual dispute over whether there are a myriad of methods to accomplish device profiles besides as	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This issue/fact is directed to the legal

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
claimed in the Asserted Claims of the '415 patent.		question of novelty and obviousness under §102 and §103, respectively, not invalidity under §101. Abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101. It is also irrelevant. The Supreme Court made it clear that "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the §101 inquiry." *Association for Molecular Pathology, et al., v. Myriad Genetics, Inc. et al.*, 569 US ____, No. 12-398, Supreme Court, June 13, 2013. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101.

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether there are a myriad of methods to accomplish device profiles besides as claimed in the Asserted Claims of the '415 patent.
14. There is a genuine factual dispute over whether there are a myriad of methods to accomplish digital image processing besides as claimed in the Asserted Claims of the '415 patent.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This issue/fact is directed to the legal question of novelty and obviousness under §102 and §103, respectively, not invalidity under §101. This issue/fact is also irrelevant because the claim is directed to a device profile, not digital image processing. Abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101. It is also irrelevant. The Supreme Court made it clear that "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the §101 inquiry." *Association for Molecular Pathology,*

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		et al., v. Myriad Genetics, Inc. et al., 569 US ____, No. 12-398, Supreme Court, June 13, 2013. The Federal Circuit has held patent claims invalid under §101 even though there were a myriad of methods to accomplish something besides the method of the challenged claims. For example, the Federal Circuit held patent claims invalid under §101 even though those claims were directed to "[t]oday's new capabilities of acquiring and using knowledge are producing myriad creative advances." *In re Ferguson*, 558 F.3d 1359, 1368 (Fed. Cir. 2009) There is no evidence that there are a myriad of methods to accomplish digital image processing besides as claimed in the Asserted Claims of the '415 patent. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the there are a myriad of methods to accomplish digital image processing besides as claimed in the Asserted Claims of the '415 patent.
15. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent cover all possible ways to achieve the provided result.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This issue/fact is directed to the legal question of novelty and obviousness under §102 and §103, respectively, not invalidity under §101. Abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101. It is also irrelevant. The Supreme Court made it clear that "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the §101 inquiry." *Association for Molecular Pathology, et al., v. Myriad Genetics, Inc. et al.*, 569 US ____, No. 12-398, Supreme Court, June 13, 2013.

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		The Federal Circuit has held patent claims invalid under §101 even though there were other of methods to accomplish something besides the method of the challenged claims. For example, the Federal Circuit held patent claims invalid under §101 even though those claims were directed to "[t]oday's new capabilities of acquiring and using knowledge are producing myriad creative advances." *In re Ferguson*, 558 F.3d 1359, 1368 (Fed. Cir. 2009) There is no evidence that the claims cover all possible ways to achieve the provided result. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415

DIGITECH'S STATEMENT OF GENUINE ISSUES	**DIGITECH'S SUPPORTING EVIDENCE**	**DEFENDANTS' RESPONSE**
		patent is invalid as invalidity under Section 101 does not depend solely on whether the claims cover all possible ways to achieve the provided result.
16. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent are tied to specific way of doing something with a computer (i.e., a specially programmed processor within a digital imaging system).	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. There is no evidence that the asserted claimss are not tied to a computer or a specific computer for doing something. The asserted claims do not contain a computer or any physical limitation tied to a computer. Even if the claims included a computer and/or processor it would not make the claims patent eligible under §101. *See, Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333-34 (a claim directed to a computer aided method of managing credit application invalid under 101 because "simply adding a 'computer aided' limitation to a claim covering an abstract concept, without more, is insufficient to render the claim patent eligible.")

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		and *CyberSource Corp. v. Retail Decisions Inc.*, 654 F.3d 1366, 1373-74 (a claim directed to a computer readable medium containing program instructions that can be executed by one or more processors of a computer to be invalid under 101 because it is drawn to an abstract idea). Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a computer. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under

DIGITECH'S STATEMENT OF GENUINE ISSUES	**DIGITECH'S SUPPORTING EVIDENCE**	**DEFENDANTS' RESPONSE**
		Section 101 does not depend solely on whether the claims are tied to specific way of doing something with a computer (i.e., a specially programmed processor within a digital imaging.
17. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent are tied to special purpose computer, i.e., a digital image processor or controller, is part of the solution, being integral to the performance of the method.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. There is no evidence that the claims are tied to special purpose computer, i.e., a digital image processor or controller, is part of the solution, being integral to the performance of the method. The asserted claims do not contain a computer or any physical limitation tied to a computer. Even if the claims included a computer and/or processor it would not make the claims patent eligible under §101. *See, Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333-34 (a claim directed to a computer aided method of managing credit application invalid under 101 because "simply

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		adding a 'computer aided' limitation to a claim covering an abstract concept, without more, is insufficient to render the claim patent eligible.") and *CyberSource Corp. v. Retail Decisions Inc.*, 654 F.3d 1366, 1373-74 (a claim directed to a computer readable medium containing program instructions that can be executed by one or more processors of a computer to be invalid under 101 because it is drawn to an abstract idea). Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a computer. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		"factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims are tied to special purpose computer, i.e., a digital image processor or controller, is part of the solution, being integral to the performance of the method.
18. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent contain an improvement over prior digital image processing technology.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech cites no support for this issue/fact. It is also irrelevant. The Supreme Court made it clear that "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the §101 inquiry." *Association for Molecular Pathology, et al., v. Myriad Genetics, Inc. et al.*, 569 US ____, No. 12-398, Supreme Court, June 13, 2013. Further, the conditions for patentability under §§102 and 103 only require that the patent claim be new and non-obvious. There is no requirement that a patent claim disclose something that is better or an improvement. There is no evidence that the claims contain an improvement over prior digital image processing technology.

DIGITECH'S STATEMENT OF GENUINE ISSUES	**DIGITECH'S SUPPORTING EVIDENCE**	**DEFENDANTS' RESPONSE**
		Polaroid, the original assignee of the patent, went bankrupt and did not find commercial success in the marketplace. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims contain an improvement over prior digital image processing technology.
19. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent amount to	Digitech cites no evidence in support of this alleged	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute."

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
nothing more than adding data derived from mathematical equations to a well-known and existing file structure	issue/fact.	This issue/fact is directed to the legal question of whether the asserted claims are within one of the four enumerated categories of §101. If the device profile consists of data derived from mathematical equations to a well-known and existing file structure then the claims are invalid under §101 because they do not fall within one of the four enumerated categories. If they include something more, they still may not fall within one of the four enumerated categories of §101 and be invalid. And, if they do fall within one of the four enumerated categories under §101, they are still invalid as an abstract idea. There is plenty of evidence that the asserted claims amount to nothing more than adding data derived from mathematical equations to a well-known and existing file structure. Even if the claims included a tag it would not make them patent eligible. *See In re Warmerdam*, 33 F.3d 1354 (Fed. Cir. 1994) (claims directed to data structure and methods for generating data structure are found to be abstract and not patent eligible under §101.) See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS'

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims amount to nothing more than adding data derived from mathematical equations to a well-known and existing file structure.
20. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent amount to nothing more than algorithms or data.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This issue/fact is directed to the legal question of whether the asserted claims are within one of the four enumerated categories of §101. If the device profile consists of data derived from mathematical equations to a well-known and existing file structure then the claims are invalid under §101 because they do not fall within one of

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		the four enumerated categories. If they include something more, they still may not fall within one of the four enumerated categories of §101 and be invalid. And, if they do fall within one of the four enumerated categories under §101 they are still invalid as an abstract idea. There is plenty of evidence that the claims amount to nothing more than algorithms or data. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims amount to nothing

DIGITECH'S STATEMENT OF GENUINE ISSUES	**DIGITECH'S SUPPORTING EVIDENCE**	**DEFENDANTS' RESPONSE**
		more than algorithms or data.
21. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent comprise transient propagating forms of signal transmission.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This issue/fact is irrelevant. The Defendants do not assert that the asserted claims "comprise transient propagating forms of signal transmission." This issue/fact is not relevant to the determination of whether the asserted claims are invalid under §101.
22. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent nothing more than the manipulation of basic mathematical constructs	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech cites no support for this issue/fact. This issue/fact is directed to the legal question of whether the asserted claims are within one of the four enumerated categories of §101. If the device profile consists of data derived from the manipulation of basic mathematical constructs then the claims are invalid under §101 because they do not fall within one of the four enumerated categories. If they include something more, they still may not fall within one of the four enumerated categories of §101 and be invalid. And, if they do fall within one of the four enumerated categories under §101 they are still invalid as an

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		abstract idea. There is plenty of evidence that the claims involve nothing more than the manipulation of basic mathematical constructs See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims involve nothing more than the manipulation of basic mathematical constructs.
23. There is a genuine factual dispute over whether the Asserted	Digitech cites no evidence in support of this	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
Claims of the '415 patent could be practiced as mental steps.	alleged issue/fact.	alleged "factual dispute." Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. This issue/fact is directed to the legal question of whether the asserted claims are within one of the four enumerated categories of §101. If the device profile can be derived through merely mental steps then the claims are invalid under §101 because they do not fall within one of the four enumerated categories. If they include something more, they still may not fall within one of the four enumerated categories of §101 and be invalid. And, if they do fall within one of the four enumerated categories under §101 they are still invalid as an abstract idea. There is plenty of evidence that the claims could be practiced as mental steps. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims could be practiced as mental steps.
24. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent could be practiced on a piece of paper.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. This issue/fact is directed to the legal question of whether the asserted claims are within one of the four enumerated categories of §101. If the device profile can be written on a piece of paper then the claims are invalid under §101 because they do

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		not fall within one of the four enumerated categories. If they include something more, they still may not fall within one of the four enumerated categories of §101 and be invalid. And, if they do fall within one of the four enumerated categories under §101 they are still invalid as an abstract idea. There is plenty of evidence that the claims could be practiced on a piece of paper. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on

DIGITECH'S STATEMENT OF GENUINE ISSUES	**DIGITECH'S SUPPORTING EVIDENCE**	**DEFENDANTS' RESPONSE**
		whether the claims could be practiced on a piece of paper.
25. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent highly generalized.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. There is plenty of evidence that the claims are highly generalized. The device profile is described merely in terms of data without any physical structure. Digitech's assertion that the device profile can be "appended to or embedded in a digital image", or part of any portion of any device in a digital imaging system, or a device in a digital imaging system, refutes its assertion that the device profile is not highly generalized. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims are highly generalized.
26. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent specific elements in the claims that limit any abstract concept within the scope of the invention.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." In addition, the "dispute" identified by Digitech does not relate to an issue of fact but is instead a legal issue properly directed to the Court. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. There is plenty of evidence that the

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		specific elements in the claims do not limit the abstract concept within the scope of the invention. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the specific elements in the claims limit the abstract concept within the scope of the invention.
27. There is a genuine factual dispute over whether the matters claimed by the Asserted Claims of the '415 patent are	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This issue/fact is directed to the legal

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
inherent in the idea of digital image processing.		question of novelty and obviousness under §102 and §103, respectively, not invalidity under §101. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. This issue is not material to the question of validity under §101. Inherency is material for validity under §112. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		patent is invalid as invalidity under Section 101 does not depend solely on whether the claims are inherent in the idea of digital image processing.
28. There is a genuine factual dispute over whether the matters claimed by the Asserted Claims of the '415 patent are disassociated with any specific application of an apparatus or activity.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. This issue is not material to the question of validity under §101. This issue is relevant to enablement under §112. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims are disassociated with any specific application of an apparatus or activity.
29. There is a genuine factual dispute over whether the device profile of the '415 patent is a machine.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This issue/fact is directed to the legal question of whether the asserted claims are within one of the four enumerated categories of §101. Further, even if the claims are a machine they are still invalid as an abstract idea. The asserted claims do not contain a machine or any physical structure of a machine. Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile a machine. There is plenty of evidence that the device profile is not a machine. The asserted claims do not contain a

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		machine or any physical limitation of a machine. Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a computer. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the device profile is a machine.
30. There is a genuine factual dispute over	Digitech cites no evidence in	This alleged issue should be ignored because Digitech has cited no

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
whether the device profile of the '415 patent is a manufacture.	support of this alleged issue/fact.	evidence to support the existence of an alleged "factual dispute." This issue/fact is directed to the legal question of whether the asserted claims are within one of the four enumerated categories of §101. Further, even if the claims are a manufacture they are still invalid as an abstract idea. There is plenty of evidence that the asserted claims are not a manufacture. The asserted claims do not contain a manufacture or any physical limitation tied to a manufacture. Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a computer. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the device profile is a manufacture.
31. There is a genuine factual dispute over whether the device profile of the '415 patent is a composition of matter.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This issue/fact is directed to the legal question of whether the asserted claims are within one of the four enumerated categories of §101. Further, even if the claims are a composition of matter they are still invalid as an abstract idea. The asserted claims do not contain any chemical components or have any relation to the types of claims found to be a composition of matter. The device profile is not a hydrocarbon, microorganism, molecule, or motor oil. See *Diamond v. Chakrabarty*, 447 US 303, 305(1980), *citing Shell Development Co. v. Watson*, 149 F. Supp. 279, 280 (DC 1957). Digitech's assertion that the device

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is a composition of matter. There is plenty of evidence that the asserted claims are not a composition of matter. See also UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the device profile is a manufacture.
32. There is a genuine factual dispute over	Digitech cites no evidence in	This alleged issue should be ignored because Digitech has cited no

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
whether the asserted method claims of the '415 patent (i.e. claims 10-15) (the "Asserted Method Claims") are tied to a particular machine or apparatus, for example the apparatuses in a digital processing system comprising a processor or controller.	support of this alleged issue/fact.	evidence to support the existence of an alleged "factual dispute." This is a legal question for the Court. It is not a factual issue. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. The test for method claims to see if they are a process is the machine or transformation test outlined in *Bilski I* and *Bilski II*. Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a particular machine or apparatus. Even if the claims included a computer and/or processor it would not make the claims patent eligible under §101. *See, Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333-34 (a claim directed to a computer aided method of managing credit application invalid under 101 because "simply adding a 'computer aided' limitation to a claim covering an abstract concept, without more, is insufficient to render the claim patent eligible.") and *CyberSource Corp. v. Retail Decisions Inc.*, 654 F.3d 1366, 1373-

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		74 (a claim directed to a computer readable medium containing program instructions that can be executed by one or more processors of a computer to be invalid under 101 because it is drawn to an abstract idea). There is plenty of evidence that the claims are not tied to a particular machine or apparatus, for example the apparatuses in a digital processing system comprising a processor or controller. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		whether the claims are tied to a particular machine or apparatus, for example the apparatuses in a digital processing system comprising a processor or controller.
33. There is a genuine factual dispute over whether the Asserted Method Claims of the '415 patent are tied to a particular machine or apparatus (see above) such that it imposes impose meaningful limits on the claim's scope.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This is a legal question for the Court. It is not a factual issue. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. The test for method claims to see if they are a process is the machine or transformation test outlined in *Bilski I* and *Bilski II*. Digitech's assertion that the device profile can be "appended to or embedded in a digital image" refutes its assertion that the device profile is tied to a particular machine or apparatus. The asserted claims do not contain meaningful limitations because they do not satisfy the machine or transformation test. As the Federal Circuit recently

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		recognized, the "Supreme Court has told us when a claim likely should not be deemed meaningfully limited, it has also given us examples of meaningful limitations which likely remove claims from the scope of the Court's judicially created exceptions to Section 101. Thus, a claim is meaningfully limited if it requires a particular machine implementing a process or a particular transformation of matter. *See Bilski*, 130 S. Ct. at 3227" *CLS Bank Int'l v. Alice Corp.*, 106 U.S.P.Q.2d 1969, 1718 (Fed.Cir. 2013)(en banc). There is plenty of evidence that the claims are not tied to a particular machine or apparatus such that it imposes impose meaningful limits on the claim's scope. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims are tied to a particular machine or apparatus such that it imposes impose meaningful limits on the claim's scope.
34. There is a genuine factual dispute over whether the Asserted Method Claims of the '415 patent transform a particular article, namely a digital image, into a different state or thing, namely a digital image with distortions ameliorated or corrected.	Digitech cites no evidence in support of this alleged issue/fact.	This alleged issue should be ignored because Digitech has cited no evidence to support the existence of an alleged "factual dispute." This is a legal question for the Court. It is not a factual issue. Moreover, the legal question of abstractness need only be addressed by the Court if the Court finds that the asserted claims fall within one of the four enumerated categories of §101, which they do not. The test for method claims to see if they are a process is the machine or transformation test outlined in *Bilski I* and *Bilski II*. By the literal terms the claimed method generates data about a device but it is not limited to performing the claim steps using any particular machine. That is, the phrase merely describes what the device profile

DIGITECH'S STATEMENT OF GENUINE ISSUES	DIGITECH'S SUPPORTING EVIDENCE	DEFENDANTS' RESPONSE
		does, not how it is generated. Similarly, the method claim's recitation of "for describing a device dependent transformation of color information content of the image to a device independent color space" and "for describing a device dependent transformation of spatial information content of the image in said device independent color space" are statements that merely describe the purpose of the first and second data, rather than limiting the disclosed method to performance on any particular machine. There is plenty of evidence that the claims do not transform a particular article, namely a digital image, into a different state or thing, namely a digital image with distortions ameliorated or corrected. See UF 1 – 20 in DEFENDANTS' STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. See Section III of MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF

DIGITECH'S STATEMENT OF GENUINE ISSUES	**DIGITECH'S SUPPORTING EVIDENCE**	**DEFENDANTS' RESPONSE**
		U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. §101. Even if the Court accepted this "factual dispute," it would not warrant denial of Defendants' motion for summary judgment that the '415 patent is invalid as invalidity under Section 101 does not depend solely on whether the claims transform a particular article, namely a digital image, into a different state or thing, namely a digital image with distortions ameliorated or corrected.

CHRISTOPHER P. BRODERICK
cbroderick@orrick.com
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: 213-629-2020
Facsimile: 213-612-2499

Attorneys for Defendants

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) **DECLARATION OF ANDREW YEN IN SUPPORT OF DEFENDANTS' REPLY ON MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) **DECLARATION OF ANDREW YEN IN SUPPORT OF DEFENDANTS' REPLY ON MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION and SIGMA CORPORATION OF AMERICA, Defendants.	CASE NO. SACV 12-01681-ODW (MRWx) **DECLARATION OF ANDREW YEN IN SUPPORT OF DEFENDANTS' REPLY ON MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01689-ODW (MRWx) **DECLARATION OF ANDREW YEN IN SUPPORT OF DEFENDANTS' REPLY ON MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01694-ODW (MRWx) **DECLARATION OF ANDREW YEN IN SUPPORT OF DEFENDANTS' REPLY ON MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

1. I am an attorney with the law firm of Orrick, Herrington & Sutcliffe LLP, counsel for FUJIFILM Corporation ("FUJIFILM"); Sigma Corporation and Sigma Corporation of America (collectively, "Sigma"); Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., and Ricoh Americas Corp. (collectively, "Ricoh"); and Konica Minolta Business Solutions, U.S.A., Inc. ("KMBUS") (collectively, "Defendants") in this matter. The following is based upon my personal knowledge, and if called as a witness I could and would testify competently thereto.

2. Attached hereto as Exhibit 1 are relevant pages from a true and correct copy of Plaintiff Digitech Image Technologies, LLC's Responses to Defendants First Set of Common Interrogatories (Nos. 1-5), served June 7, 2013 ("Digitech's Discovery Responses").

3. Attached hereto as Exhibit 2 is a color markup of a true and correct copy of the '415 patent.

4. The color markup of Exhibit 2 highlights the sections of the '415 patent that Digitech relied upon in its Discovery Responses and/or its Response to Defendants' Motion for Summary Judgment of Invalidity of U.S. Patent No. 6,128,415 Under 35 U.S.C. 101 ("Digitech's Response to MSJ") to support its position on the meaning of "device profile."

5. Sections marked in GREEN on Exhibit 2 are cited only in Digitech's Discovery Responses.

6. Sections marked in RED on Exhibit 2 are cited only in Digitech's Response to MSJ.

7. Sections marked in YELLOW in Exhibit 2 are cited in both Digitech's Discovery Responses and Digitech's Response to MSJ.

I declare on penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed this 17th day of July, 2013 in Los Angeles, California.

Andrew Y. Yen

EXHIBIT 1

John J. Edmonds (State Bar No. 274200)
jedmonds@cepiplaw.com
Stephen F. Schlather (admitted *pro hac vice*)
sschlather@cepiplaw.com
Johnathan K. Yazdani (admitted *pro hac vice*)
jyazdani@cepiplaw.com
COLLINS EDMONDS POGORZELSKI
SCHLATHER & TOWER, PLLC
1851 East First Street, Suite 900
Santa Ana, California 92705
Telephone: (951) 708-1237
Facsimile: (951) 824-7901

Attorneys for Plaintiff,
Digitech Image Technologies, LLC

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)** Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PANASONIC CORPORATION and PANASONIC CORPORATION OF NORTH AMERICA, Defendants.	CASE NO. SACV 12-01667-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. CANON INC. and CANON U.S.A., INC., Defendants.	CASE NO. SACV 12-01670-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SAKAR INTERNATIONAL, INC. d/b/a VIVITAR, Defendant.	CASE NO. 8:12-CV-01673-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. LEAF IMAGING LTD (d/b/a Mamiyaleaf), and MAMIYA AMERICA CORPORATION, Defendants.	CASE NO. 8:12-CV-01675-ODW (MRW) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. OLYMPUS CORPORATION AND OLYMPUS IMAGING AMERICA, INC., Defendants.	CASE NO. SACV 12-01676-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)** Judge: Hon. Otis D. Wright, II
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SONY CORPORATION; SONY CORPORATION OF AMERICA; and SONY ELECTRONICS INC., Defendants.	CASE NO. SACV 12-01678-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. GENERAL IMAGING CO., Defendants.	CASE NO. 8:12-cv-01680-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION ET AL., Defendant(s).	CASE NO. SACV 12-01681-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. NIKON CORPORATION AND NIKON INC., Defendants.	CASE NO. SACV 12-01685-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01689-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. XEROX CORPORATION, Defendant.	CASE NO. SACV 12-01693-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01694-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. VICTOR HASSELBLAD AB and HASSELBLAD USA INC., Defendants.	CASE NO. 8:12-cv-01696-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. CASIO COMPUTER CO LTD, et al., Defendant(s).	CASE NO. SACV 12-01697-ODW (MRW) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ASUS COMPUTER INTERNATIONAL and ASUSTEK COMPUTER INC., Defendants.	CASE NO. SACV 12-02122 ODW (SSx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. MOTOROLA MOBILITY LLC, et al., Defendant.	CASE NO. SACV 12-02123-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. LEICA CAMERA AG and LEICA CAMERA INC., Defendants.	CASE NO. SACV 12-01677-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ACER AMERICA CORPORATION and ACER INC., Defendants.	CASE NO. SACV 12-01677-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. TOSHIBA CORPORATION, TOSHIBA AMERICA, INC., TOSHIBA AMERICA BUSINESS SOLUTIONS, INC., and TOSHIBA AMERICA INFORMATION SYSTEMS, INC. Defendants.	CASE NO. SACV 12-01677-ODW (MRWx) **PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)**

Pursuant to 33 of the Federal Rules of Civil Procedure, Plaintiff Digitech Image Technologies LLC ("Digitech") responds to the First Common Interrogatories (Nos. 1-5) propounded by Defendants Electronics for Imaging, Inc., Panasonic Corporation, Panasonic Corporation of North America, Canon, Inc., Canon U.S.A., Inc., Sakar International, Inc. d/b/a Vivitar, Leaf Imaging LTD (d/b/a Mamiyaleaf), Mamiya America Corporation, Olympus Corporation, Olympus Imaging America, Inc., Leica Camera AG, Leica Camera Inc., Sony Corporation, Sony Corporation of America, Sony Electronics Inc., FUJIFILM

Corporation, General Imaging Co., Sigma Corporation, Sigma Corporation of America, Nikon Corporation, Nikon Inc., Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., Ricoh Americas Corp., Xerox Corporation, Konica Minolta Business Solutions, U.S.A., Inc., Victor Hasselblad AB, Hasselblad USA Inc., Casio Computer Co. Ltd., Casio America, Inc., ASUS Computer International, ASUSTeK Computer Inc., Motorola Mobility LLC, Acer Inc., Acer America Corporation, Toshiba Corporation, Toshiba America, Inc., Toshiba America Business Solutions, Inc., and Toshiba America Information Systems, Inc. (collectively "Defendants"), as follows:

OBJECTIONS TO DEFINITIONS

1. Digitech objects to the definition of “Digitech,” “You” and/or “Your” to the extent it is overbroad and unduly burdensome, and to the extent it seeks information which is neither relevant nor reasonably calculated to lead to the discovery of admissible evidence. Subject to the foregoing, in responding to these discovery requests, Digitech will construe “Digitech,” “You” and/or “Your” as Digitech Image Technologies, LLC and its employees, directors, officers and agents.

2. Digitech objects to the definition of “Polaroid” to the extent that “Affiliates” is vague and over broad.

3. Digitech objects to the definition of “Acacia” to the extent that the definition of “Affiliates” is vague, and over broad.

4. Digitech objects to the definition of "Digitech Matters" because “disputes” is vague, undefined and over broad. In responding to these requests, Digitech will construe “Digitech Matters” as the patent infringement lawsuits involving the patent-in-suit pending before this Court.

5. Digitech objects to the term "Prior Art" to the extent it is vague and/or would require a legal conclusion.

6. Digitech objects to the definitions of “communication(s),” “document(s)” and “thing(s)” to the extent they are vague, overbroad and unduly burdensome, and to the extent they exceeds the scope of FRCP 34. In responding to these discovery requests, Digitech will construe “communication(s),” “document(s),” and “thing(s)” in accordance with FRCP 34. Further, Digitech objects to these definitions, including on the basis of undue burden, to the extent they seek to exceed the requirements of any orders (including anticipated orders) of the Court regarding the discovery of emails and/or ESI. In responding to these discovery requests, Digitech will follow all applicable orders of the Court.

7. Digitech objects to the definition of "concern," "relate," reflect," or "refer" to the extent it is vague, overbroad and unduly burdensome. In responding to these discovery requests, Digitech will construe "concern," "relate," reflect," and "refer" in accordance with their ordinary and customary meaning.

8. Digitech objects to the definition of "evidencing" to the extent it is vague, overbroad and unduly burdensome. In responding to these discovery

requests, Digitech will construe "evidencing" in accordance with their ordinary and customary meaning.

9. Digitech objects to the definition of "identify" to the extent it is overbroad and unduly burdensome. In responding to these discovery requests, Digitech will reasonably identify persons, documents and things.

10. Digitech objects to the definitions of "Acacia" and "Polaroid" to the extent that the definition of "Affiliates" is vague and over broad.

11. Digitech objects to the term "related patent and/or patent application" to the extent that "relate in any way to the Asserted Patent" is vague and over broad.

12. The foregoing objections to definitions should be deemed incorporated by reference into all responses below as applicable.

RESPONSES TO INTERROGATORIES

INTERROGATORY NO.1:

Separately, for each claim element listed below in a) through e) that is also contained in any claim that You allege is infringed, specifically identify all portions of the Asserted Patent specification that You contend support the claim element pursuant to 35 U.S.C. § 112, first paragraph:

(a) "device profile";

(b) "second data for describing a device dependent transformation of spatial information content of the image in said device independent color space";

(c) "generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions";

(d) "generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions"; and

(e) "data for describing a device dependent transformation of spatial information content of the image **to** a device independent color space" (emphasis supplied.)

RESPONSE:

Subject to and without waiving the objections to definitions, Digitech objects to this interrogatory because it has multiple discreet subparts, and because it comprises five separate and distinct interrogatories. Digitech also objects to this interrogatory to the extent it is premature and to the extent it seeks privileged work product, which shall not be provided in response to this interrogatory.

Subject to the foregoing, Digitech's present non-privileged, non-expert contentions potentially responsive to this interrogatory (as presently understood), based upon the incomplete discovery at this early stage in the litigation, are as follows:

device profile	Abstract; 1:6-11; 1:64-2:1; 2:7-9; 2:13-16; 2:16-18; 2:18-22; 2:22-26; 2:26-28; 5:11-12
second data for describing a device dependent transformation of spatial information content of the image in said device independent color space	5:3-10; 5:11-23
generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions	1:55-2:1
generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions	5:3-10; 5:11-25
data for describing a device dependent transformation of spatial information content of the image to a device independent color space	1:64-2:9; 5:3-25

INTERROGATORY NO. 2:

Specifically identify all Persons licensed under the Asserted Patent, all Persons who have made, used, or sold products under a license, the products that were made, used or sold under a license, and the date ranges those products were made, used and sold.

RESPONSE:

work product. Further, Digitech objects to the extent this interrogatory is premature.

Subject to the foregoing, Digitech's present non-privileged, non-expert contentions potentially responsive to this interrogatory (as presently understood), based upon the incomplete discovery at this early stage in the litigation, are as follows:

Digitech is not the original assignee of the '445 patent. On information and belief, the invention(s) of the '445 patent were conceived and first reduced to practice by the named inventors Bror Hultgren, Richard Cottrell and Jay Thornton. Digitech expects that Messrs. Hultgren, Cottrell and Thornton will be deposed and/or will testify at trial, and that they may provide information and/or testimony requested by this interrogatory. Digitech expects that it will defer to the testimony of Mr. Hultgren, Mr. Cottrell and/or Mr. Thornton regarding conception and reduction to practice, and it should be deemed incorporated herein by reference as applicable.

Dated: June 7, 2013

Collins Edmonds Pogorzelski Schlather & Tower PLLC

By: /s/ John J. Edmonds
JOHN J. EDMONDS

Attorney for Plaintiff
DIGITECH IMAGE TECHNOLOGIES, LLC

CERTIFICATE OF SERVICE

I, John J. Edmonds, declare as follows:

I am over the age of eighteen years and am not a party to this action. I am employed at the law firm of Collins, Edmonds, Pogorzelski, Schlather & Tower, PLLC and I am a member of the bar of this Court. I hereby certify that on June 7, 2013, the following document was transmitted via email using Plaintiff's email distribution list for the Defendants:

PLAINTIFF DIGITECH IMAGE TECHNOLOGIES, LLC'S RESPONSES TO DEFENDANTS FIRST SET OF COMMON INTERROGATORIES (NOS. 1-5)

I further certify that the attached document was sent on June 7, 2013, via the email to all known counsel of record in this action via the email distribution list being used in this case.

June 7, 2013

/s/ *John J. Edmonds*
John J. Edmonds

ATTORNEY FOR DIGITECH IMAGE TECHNOLOGIES LLC

EXHIBIT 2

US006128415A

United States Patent [19]

Hultgren, III et al.

[11] **Patent Number: 6,128,415**

[45] **Date of Patent: *Oct. 3, 2000**

[54] **DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM**

[75] Inventors: **Bror O. Hultgren, III**, Ipswich; **F. Richard Cottrell**, Easton; **Jay E. Thornton**, Watertown, all of Mass.

[73] Assignee: **Polaroid Corporation**, Cambridge, Mass.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/709,487**

[22] Filed: **Sep. 6, 1996**

[51] **Int. Cl.**[7] **G06K 9/00**; G06K 9/36; G03F 3/08; G03F 3/10

[52] **U.S. Cl.** **382/276**; 382/162; 382/167; 382/266; 345/431; 358/518; 358/527

[58] **Field of Search** 382/167, 276, 382/266, 239, 162; 358/518, 527, 520; 345/418, 431

[56] **References Cited**

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Murch "New Paradigms for Visualization," IEEE. pp. 550–551, 1990.

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Primary Examiner—Andrew J. Johns
Assistant Examiner—Daniel G. Mariam
Attorney, Agent, or Firm—Robert J. Decker

[57] **ABSTRACT**

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

33 Claims, 3 Drawing Sheets

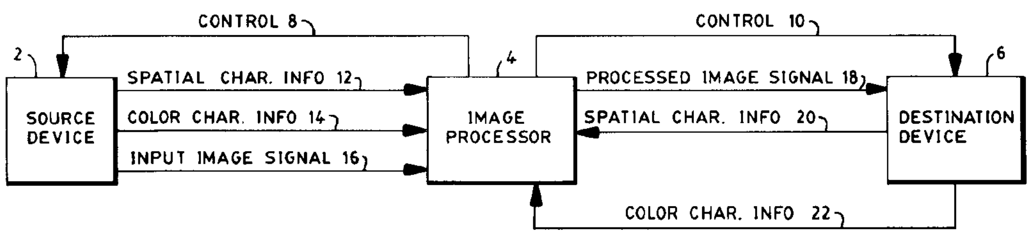

EXHIBIT 2
PAGE 16

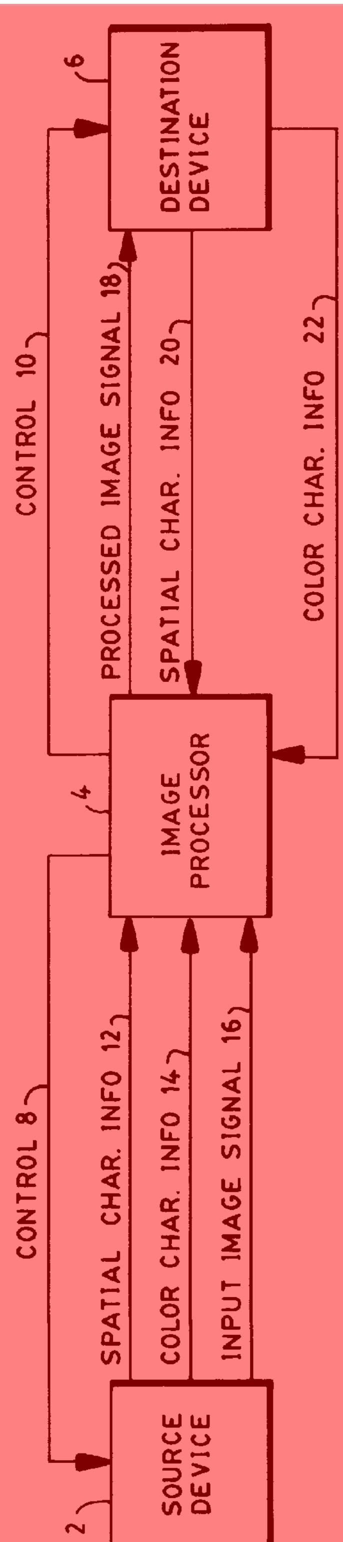
DESTINATION DEVICE
6
CONTROL 10
PROCESSED IMAGE SIGNAL 18
SPATIAL CHAR. INFO 20
COLOR CHAR. INFO 22
IMAGE PROCESSOR
4
CONTROL 8
SPATIAL CHAR. INFO 12
COLOR CHAR. INFO 14
INPUT IMAGE SIGNAL 16
SOURCE DEVICE
2

FIG. 1

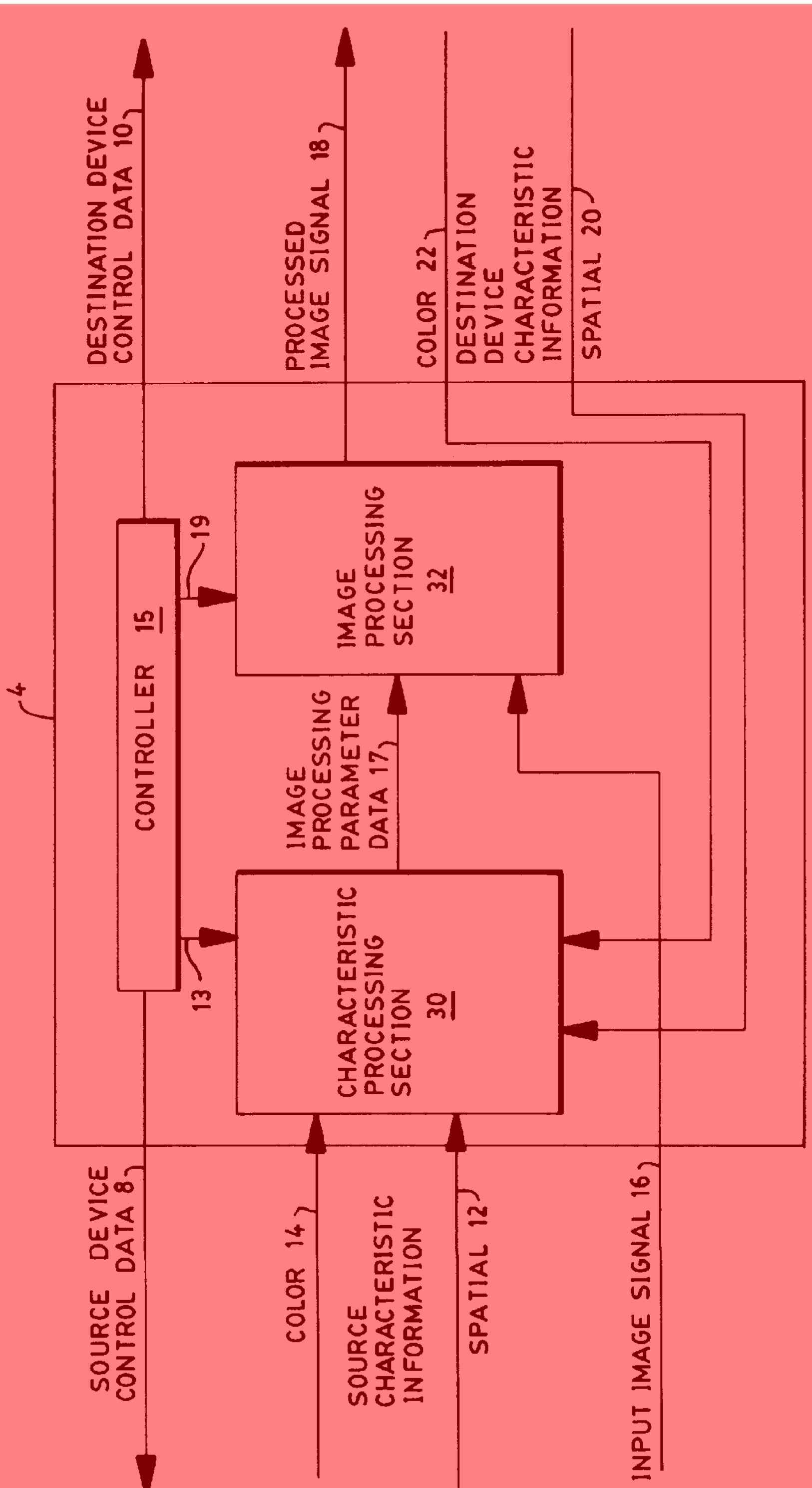
DESTINATION DEVICE CONTROL DATA 10
PROCESSED IMAGE SIGNAL 18
COLOR 22
DESTINATION DEVICE CHARACTERISTIC INFORMATION
SPATIAL 20
4
CONTROLLER 15
19
13
IMAGE PROCESSING SECTION 32
IMAGE PROCESSING PARAMETER DATA 17
CHARACTERISTIC PROCESSING SECTION 30
SOURCE DEVICE CONTROL DATA 8
COLOR 14
SOURCE CHARACTERISTIC INFORMATION
SPATIAL 12
INPUT IMAGE SIGNAL 16

FIG. 2

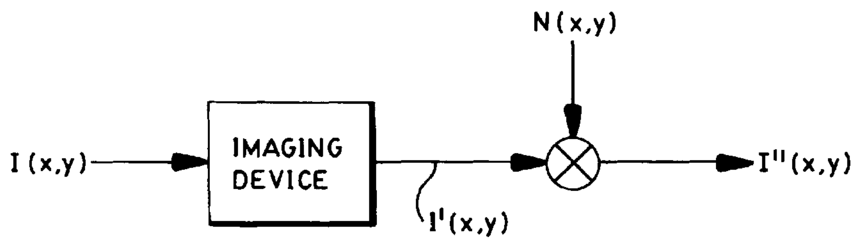
N(x,y)
I(x,y)
IMAGING DEVICE
I'(x,y)
I''(x,y)

FIG. 3

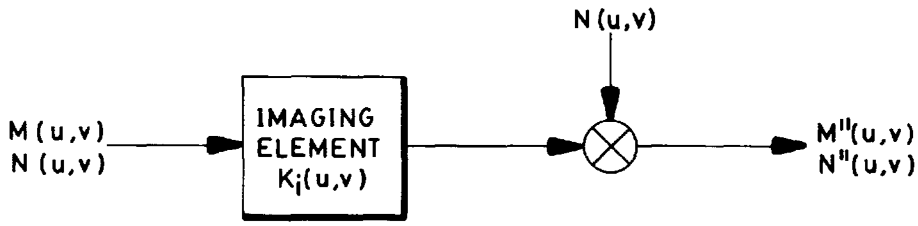
N(u,v)
M(u,v)
N(u,v)
IMAGING ELEMENT
K_i(u,v)
M''(u,v)
N''(u,v)

FIG. 4

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed generally towards digital image processing and more specifically towards generation and use of an improved device profile for describing both spatial and color properties of a device within an image processing system, so that a processed image can be more accurately captured, transformed or rendered.

2. Description of the Prior Art

Digital image processing involves electronically capturing an image of a scene, altering the captured image in some desired fashion and passing the altered image to an output device. An upstream element of a digital image processing system can be thought of as a source device, whereas a downstream element can be thought of as a destination device. For instance, a simple image processing system could include an acquisition device such as a digital camera, camcorder, scanner, CCD, etc., a color processor for processing the colors of the image, and an output device, such as a printer, monitor, computer memory, etc. When considering a communication between the acquisition device and the color processor, the acquisition device is deemed as the source device whereas the color processor is deemed as the destination device. When considering a communication between the color processor and the output device, the color processor is deemed as the source device whereas the output device is deemed as the destination device.

All imaging devices, either image acquisition or image display, will impose distortions of the color and spatial components of the image data.

Historically, industry has chosen to correct these distortions with device dependent solutions. It is common practice in the industry that an integral part of the design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices to ameliorate these distortions. For example, electronic peaking filters are often employed in video capture devices to correct for the blurring effects of anti-aliasing filters and amplifier frequency response. Electronic imaging devices are commonly designed to function with specific upstream (in the case of display devices) or downstream (in the case of image sources) devices to provide quality images. For example, image capture devices commonly transform the image digits to compensate ('gamma corrected') for the CRT volts-luminance characteristics of CRT displays. Such design considerations provide a device dependent model for that specific implementation of an image processing system, but do not provide the same degree of image quality when substituting an alternative device.

Recently, device independent paradigms for the characterization of color information in an image processing system have been developed and are being implemented: Color Sync, developed by Apple Computer and KCMS, developed by Eastman Kodak Co., are examples of systems or components supporting a device independent color paradigm. This paradigm is based upon a characterization of the image pixel data (digits) in a device independent color space—e.g. CIE L*a*b* or CIE XYZ, and the use of a Color Management System. The characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device. However, the spatial characteristics of digital imaging devices are still modified in the context of the device dependent model described above.

In order to improve processing flexibility and versatility, it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system. This paradigm will capture the spatial characterization of the imaging device in a tagged file format, referred to as a device spatial profile.

SUMMARY OF THE INVENTION

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured chromatic response and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned aspects and other features of the invention are described in detail in conjunction with the accompanying drawings in which the same reference numerals are used throughout for denoting corresponding elements and wherein:

FIG. 1 is a block diagram of a basic digital image processing system according to the invention;

FIG. 2 is a detailed block diagram of the image processor of FIG. 1;

FIG. 3 is a model of characteristic functions sufficient to reconstruct signal and noise power distributions for linear, stationary image systems having additive noise; and

FIG. 4 is a model of the effect of an image processing element upon an image.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A simplified version of a digital image processing system is shown in the block diagram of FIG. 1. The acquisition device 2, for instance a digital camera, acquires an image which is represented as the input image signal 16. The image processor 4 receives the input image signal 16, acquisition device spatial characteristic information 12 and acquisition device color characteristic information 14 in response to a control signal 8. The image processor 4 also receives output device spatial characteristic information 20 and output device color characteristic information 22 from the output device 6 in response to a control signal 10. After processing the input image signal 16 in accordance with all the signals received by the processor 4, the image processor 4 sends the processed image signal 18 to output device 6, for instance a printer which produces a hardcopy of the processed image.

An image includes both spatial and chromatic information. The spatial content of an image can be described by its signal and noise power distributions. An image's signal or noise power distribution will be transformed by a device but

does not give an unique description of the device because the distributions are image specific and they will be determined by the result of all preceding image transformations. However for one class of imaging devices namely linear, stationary imaging systems with additive noise, characteristic functions sufficient to reconstruct the signal and noise power distributions can be constructed. In practice many systems not conforming to these conditions can be approximated as linear, stationary imaging systems with additive noise having sufficient accuracy to enable the prediction of perceived image quality if not full image reconstruction.

Spatial characteristics of the elements of an image processing system or platform can be represented in at least two forms. In a first form, a characteristic processing section **30** of the image processing platform contains spatial characteristic functions describing added noise and image signal transform characteristics of the source and destination devices. In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, the characteristic processing section **30** contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. patent application Ser. No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation. This patent application is hereby incorporated in its entirety to provide supplemental background information which is non-essential but helpful in appreciating the applications of the present invention.

FIG. **2** is a detailed diagram of the image processor **4** of FIG. **1**. The image processor **4** includes a controller **15**, a characteristic processing section **30** and an image processing section **32**. The characteristic processing section **30** produces image processing data **17** in response to color source characteristic information **14**, spatial source characteristic information **12**, color destination device characteristic information **22**, spatial destination device characteristic information **20**, and a first control signal **13** from the controller **15**. In turn, the image processing section **32** produces a processed image signal **18** in response to the image processing parameter data **17**, an input image signal **16** and a second control signal **19** from the controller **4**. The controller **15** also generates both source device control data **8** and destination device control data **10**.

If I(x,y) represents the intensity distribution over the spatial coordinates (x,y) of the image and I(u,v) represents the corresponding frequency domain representation of the image constructed from the Fourier transform of I(x,y), then the transformation of the image by a linear, stationary imaging element can be represented as shown in FIG. **3**. In the spatial domain the transformation is described by a Linear function S(g(x,y)):

$$I'(x,y)=S(I(x,y)) \tag{1}$$

$$I''(x,y)=S(I(x,y)+N(x,y)) \tag{2}$$

and in the Fourier (spatial frequency) domain by the Fourier Transform S(G(u,u)) of S(g(x,y)):

$$I(u,v)=S(I(u,v)) \tag{3}$$

$$I''(u,v)=S(I(u,v)+N(u,v)) \tag{4}$$

where N(x,y) and its corresponding Fourier Transform N(u,v) represents the additive noise.

For a linear, stationary imaging system, the transfer function S(g(x,y)) is given by

$$S(g(x,y))=s(x,y)\otimes g(x,y) \tag{5}$$

where $\otimes$ signifies convolution. S(G(u,v) is given by:

$$S(G(u,v))=S(u,v)*G(u,v) \tag{6}$$

where * signifies point multiplication.

In principle S(u,v) can be computed from the ratio of the output/input signal power distributions. In practice, S(u,v) is determined from fourier analysis of images of step input images via edge gradient analysis, or point or line images via point or line spread analysis. The transfer function is commonly called the Modulation Transfer Function (MTF).

If the input image is an uniform image $I(x,y)=I_0$, Fourier analysis of the output image will yield the Wiener Noise Power Spectrum N(u,v) which is the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

As stated previously, most real systems violate the criteria for being linear and stationary; and while introducing additive noise, that noise is often gray level dependent. This type of noise is referred to as non-linear, non-stationary, gray level dependent additive noise.

If a number of uniform field images, each described by a constant intensity I_y (where Y represents the luminance level) are processed by a device, Fourier analysis of the output images will yield Wiener Noise Power Spectra $N_y(u,v)$. The set of gray level dependent Wiener Noise Power Spectra represents the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

For non-linear image transforms a set of signal level dependent MTFs could, in principle, be generated to represent the characteristic functions describing the signal transform in the imaging device. In practice a single characteristic function can be generated from an ensemble average of MTFs or a small signal approximation. In general all of these characteristic functions are two-dimensional functions which are represented as M(u,v).

For non-stationary image transforms the image signal transform characteristic function can, in principle, be represented by a multi-dimensional function, M(x,y,u,v), generated from a local fourier analysis of the point spread function located at the position (x,y). In practice the characteristic function can be approximated by an ensemble average of the position dependent multi-dimensional function M(x,y,u,v).

$$M(u,v)=\langle M(x,y,u,v)\rangle_{xy} \tag{7}$$

where the operation $\langle M(x,y,u,v)\rangle_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y.

The processing of spatial characteristic functions in the image processing system of the preferred embodiment is model based. For a linear imaging system with additive noise, each image processing element is represented by a transfer function that is a model of the effect of that image processing element upon an image as shown in FIG. **4** and defined by equations (7) and (8) in the frequency domain.

$$M''(u,v)=Ki(u,v)*M(u,v) \tag{8}$$

$$N''(u,v)=Ki^2(u,v)*N(u,v)+Ni(u,v) \tag{9}$$

For non-linear imaging elements, the transfer function may be a more general representation of the characteristic func-

tions presented to the imaging element and evaluated in terms of a model of the imaging element.

Spatial characteristic functions are generated from fourier analysis of selected target images. Characteristic functions (a) may be scalar, one or two dimensional arrays for at least one of the device N channels, (b) are evaluated over the spatial frequency range 0 to the Nyquist frequency in equal frequency intervals, and (c) for source devices may be stated either in a proprietary processing space or in device independent space.

In the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format, as described in the ICC Profile Specification, version 3. 10b dated Oct. 21, 1995. The tagged format should include information as to which class the particular characteristic function belongs, i.e. Modulation Transfer Functions, Wiener Noise Power Spectra, or gray level dependent Wiener noise masks. The tagged format should also include information sufficient to identify both the relevant units of spatial frequency and the dimensionality of the characteristic functions. Propagation of characteristic functions is calculated within the context of the model based image processing system.

It is to be understood that the above described embodiments are merely illustrative of the present invention and represent a limited number of the possible specific embodiments that can provide applications of the principles of the invention. Numerous and varied other arrangements may be readily devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention as claimed.

What is claimed is:

1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.

2. The device profile of claim 1 wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

3. The device profile of claim 2, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

4. The device profile of claim 1, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

5. The device profile of claim 1, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

6. The device profile of claim 5, wherein said gray level dependent additive noise is spatially dependent.

7. The device profile of claim 1, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

8. The device profile of claim 7, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

9. The device profile of claim 1 wherein, for said device, the second data is generated through use of spatial stimuli and device response characteristic functions.

10. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;

generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and

combining said first and second data into the device profile.

11. The method of claim 10 wherein, for said device:

said second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

12. The method of claim 11 wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

13. The method of claim 11 wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

14. The method of claim 11, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

15. The method of claim 13, wherein said gray level dependent additive noise is spatially dependent.

16. The method of claim 11, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

17. The method of claim 16, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

18. A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space through use of chromatic response characteristic functions; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device independent color space through the use of spatial characteristic fimctions describing image spatial transform characteristics in said device independent color space.

19. The system of claim 18, wherein the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

20. The system of claim 19, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

21. The system of claim 18, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

22. The system of claim 18, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

23. The system of claim **22**, wherein said gray level dependent additive noise is spatially dependent.

24. The system of claim **18**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

25. The system of claim **24**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

26. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

27. The device profile of claim **26** wherein, for said device, the data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

28. The device profile of claim **27**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

29. The device profile of claim **26**, wherein the data is represented by characteristic functions describing a gray level dependent additive noise in said device.

30. The device profile of claim **26**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

31. The device profile of claim **30**, wherein said gray level dependent additive noise is spatially dependent.

32. The device profile of claim **26**, wherein the data is represented by characteristic functions describing spatially dependent additive noise in said device.

33. The device profile of claim **32**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

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John J. Edmonds (State Bar No. 274200)
jedmonds@cepiplaw.com
Stephen F. Schlather (Admitted PHV)
sschlather@cepiplaw.com
COLLINS EDMONDS POGORZELSKI
SCHLATHER & TOWER, PLLC
1851 East First Street, Suite 900
Santa Ana, California 92705
Telephone: (951) 708-1237
Facsimile: (951) 824-7901

Attorney for Plaintiff,
DIGITECH IMAGE TECHNOLOGIES, LLC

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION ET AL., Defendant(s).	CASE NO. SACV 12-01681-ODW (MRWx) PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013

	Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01689-ODW (MRWx) PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01694-ODW (MRWx) PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

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I. Introduction.

The claimed invention of the '415 patent constitutes a novel improvement of digital imaging technology. This invention is directors towards "digital image processing and more specifically towards generation and use of an improved device profile for describing both spatial and color properties of a device within an image processing system, so that a processed image can be more accurately captured, transformed or rendered." Ex. 1 ('415 patent), 1:7-11. The asserted claims of the '415 patent are claims 1-6, 9-15 and 27-31. The independent asserted claims are 1, 10 and 26. Independent claims 1 and 26 are directed to certain specified "device profiles" and independent claim 10 is directed to a method for generating such device profiles.

"Digital image processing involves electronically capturing an image of a scene, altering the captured image in some desired fashion and passing the altered image to an output device." *Id., 1*:13-17. "For instance, a simple image processing system could include an acquisition device such as a digital camera, camcorder, scanner, CCD, etc., a color processor for processing the colors of the image, and an output device, such as a printer, monitor, computer memory, etc." Id., 1:19-23.

"All imaging devices, either image acquisition or image display, will impose distortions of the color and spatial components of the image data." *Id.*, 1:32-34. "Historically, industry has chosen to correct these distortions with device dependent solutions." *Id.*, 1:35-36. *"It is common practice in the industry that an integral part of the design and calibration of such devices is the characterization of these distortions in the* image data and

modifications of the design of the devices to ameliorate these distortions." *Id.*, 1:36-40. As stated in the specification "[a]n improved device profile includes both chromatic characteristic information and spatial characteristic information to predict both color and spatial characteristic functions of an imaging element or device." *Id., 1*:15-17.

Defendants' arguments for invalidity of the asserted claims lack persuasiveness, pertinent legal support or evidentiary support; and, at a minimum, there are factual disputes underlying the § 101 analysis that preclude summary judgment. For the reasons noted herein, Defendants' Motion should be denied.

II. Argument.

A. Legal Standards for Summary Judgment.

Plaintiff presumes the Court's familiarity with the standard for summary judgment and the burdens and presumptions applied therewith. *See* FRCP 56. Defendants allege that "[w]hether patent claims are invalid for failure to claim statutory subject matter under §101 is a question of law and, therefore, well suited for summary judgment." Doc 64-1, pp. 5-6. However, Defendants miss the analysis under § 101, while ultimately a legal determination, is rife with underlying factual issues. *Ultramercial, Inc. v. Hulu, LLC*, --- F.3d ---, 2013 WL 3111303, *3 (Fed. Cir. June 21, 2013).[1] In the present case, there are material and substantial facts in dispute, as elaborated herein. At least due to these disputed material factual matters,

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[1] *See also In re Comiskey*, 554 F.3d 967,975 (Fed. Cir. 2009) (en banc) (noting that section 101 determinations typically turn on "subsidiary factual issues"); *Arrhythmia Research Tech., Inc. v. Corazonix Corp.*, 958 F.2d 1053, 1055-56 (Fed. Cir. 1992) ("Whether a claim is directed to statutory subject matter is a question of law ... determination of this question may require findings of underlying facts specific to the particular subject matter and its mode of claiming []").

Defendants' motion should be denied. *See, e.g, Insured Deposits Conduit, LLC v. Index Powered Fin. Servs., LLC*, 2008 WL 5691349, at *3-*4 (S.D. Fla. Mar. 14,2008) (denying summary judgment on § 101 issue because of "one subsidiary factual issue which remains to be decided").

Moreover, each claim of a patent is presumed to be valid and any attack on an issued patent based on a challenge to the eligibility of the subject matter must be proven by clear and convincing evidence. *Ultramercial*, 2013 WL 3111303, *6. Therefore a defendant requesting summary judgment of invalidity has the additional "burden of showing that there is an undisputed record from which a finder of fact would find by clear and convincing evidence that the [patent] is invalid." *Therasense, Inc. v. Becton, Dickinson & Co.*, 2007 WL 2028197, at *3 (N.D. Cal. July 10,2007). Defendants have not carried -- and cannot carry -- their burden. Further, "[a]t summary judgment, the district court may choose to construe the claims in accordance with this court's precedent, or if not it may choose to give a construction most favorable to the patentee. *Ultramercial,*2013 WL 3111303, *3.

B. Section 101 of the Patent Act.

The Patent Act controls the inquiry into patentable subject matter. 35 U.S.C. § 101. Though the Supreme Court has recognized exceptions for laws of nature, physical phenomena, and abstract ideas, it has made clear too broad an interpretation of these exclusions from the grant in § 101 "could eviscerate patent law." Prometheus, 132 S.Ct. at 1293. Thus, such exceptions "should apply narrowly." *Ultramercial,* 2013 WL 3111303*6. "Indeed, the Supreme Court has cautioned that, to avoid improper restraints on statutory

language, acknowledged exceptions thereto must be rare." *Id.*

A claim is not patent eligible only if, instead of claiming an application of an abstract idea, the claim is instead to the abstract idea itself. *Ultramercial,* 2013 WL 3111303, *7; *See Mayo Collaborative Services v. Prometheus Laboratories, Inc.,* 566 U.S. ——, 132 S.Ct. 1289, 1294, 182 L.Ed.2d 321 (2012). In determining on which side of the line the claim falls, the court must focus on the claim as a whole. *Diamond v. Diehr*, 450 U.S. 175, 188, 185, 101 S.Ct. 1048, 67 L.Ed.2d 155 (1981); *Ultramercial,* 2013 WL 3111303, *8. Courts have "long-recognized that any claim can be stripped down, simplified, generalized, or paraphrased to remove all of its concrete limitations, until at its core, something that could be characterized as an abstract idea is revealed." *Ultramercial*, 2013 WL 3111303, *8. "A court cannot go hunting for abstractions by ignoring the concrete, palpable, tangible limitations of the invention the patentee actually claims." *Id. See Prometheus*, 132 S.Ct. at 1297.

A claim may be premised on an abstract idea and, indeed, the abstract idea may be of central importance to the invention—the question for patent eligibility is whether the claim contains limitations that meaningfully tie that abstract idea to an actual application of that idea through meaningful limitations. *Ultramercial,* 2013 WL 3111303, *8. For this analysis, the "the Supreme Court has provided some guideposts." *Ultramercial,* 2013 WL 3111303, *8.

First, the Supreme Court has stated that a claim is not meaningfully limited if it merely describes an abstract idea or simply adds "apply it." *See Prometheus*, 132 S.Ct. at 1297. Thus, if a claim covers all practical applications of an abstract idea, it is not meaningfully

limited. *See id.* at 1301–02. *Ultramercial,* 2013 WL 3111303, *10.

Second, even if a claim does not wholly pre-empt an abstract idea, it still will not be limited meaningfully if it contains only insignificant or token pre- or post-solution activity—such as identifying a relevant audience, a category of use, field of use, or technological environment. *See Prometheus*, 132 S.Ct. at 1297–98, 1300–01.

Third, the Supreme Court has stated that a claim is not meaningfully limited if its purported limitations provide no real direction, cover all possible ways to achieve the provided result, or are overly-generalized. *Ultramercial,* 2013 WL 3111303, *11. *See Prometheus*, 132 S.Ct. at 1300.

There are also additional guideposts specific to computer-implemented inventions. *Ultramercial,* 2013 WL 3111303, *13. "This inquiry focuses on whether the claims tie the otherwise abstract idea to a specific way of doing something with a computer, or a specific computer for doing something; if so, they likely will be patent eligible." *Ultramercial,* 2013 WL 3111303, *13. *See* Bilski v. Kappos, —— U.S. ——, 130 S.Ct. 3218, 3227, 177 L.Ed.2d 792 (2010) ("*Bilski II*") "While no particular type of limitation is necessary, meaningful limitations may include the computer being part of the solution, being integral to the performance of the method, or containing an improvement in computer technology." *Ultramercial,* 2013 WL 3111303, *13. *See SiRF Tech., Inc. v. Int'l Trade Comm'n*, 601 F.3d 1319, 1332–33 (Fed. Cir. 2010). A special purpose computer, *i.e.*, a new machine, specially designed to implement a process may be sufficient.

Finally, the Federal Circuit has held that "[i]nventions with specific applications or

improvements to technologies in the marketplace are not likely to be so abstract that they override the statutory language and framework of the Patent Act." *Research Corp. Techs., Inc. v. Microsoft Corp*., 627 F.3d 859, 869 (Fed. Cir. 2010).

C. A "device profile" of the '415 patent is tangible, specific and not abstract.

Including in the context of the '415 patent, one of ordinary skill in the art[2] would understand that the device profile of the claimed invention tangibly exists as both (1) an *integral* part of the *design and calibration* of a *processor* device within a digital image processing system; and (2) a "tag" appended to or embedded in a digital image obtained using a digital image processing system. Cannizzo Declaration, ¶ 5.

As to the device profile of the claimed invention tangibly existing as an *integral* part of the *design and calibration* of a *processor* device in a digital image processing system, the '415 specification states, *inter alia,* that an exemplary image processing system includes an "input device," "processor" and "output device. Ex. 1*,* 1:19-23; Cannizzo Declaration, ¶ 6. This is illustrated in FIG. 1 -- "a block diagram of a basic digital image *processing system according to the invention*," Ex. 1, 2:36-37. This is also illustrated by FIG. 2 --"a detailed diagram of the image processor 4 of FIG. 1, Ex. 1, 3:32-33, -- wherein image processor 4 includes a controller 15, a characteristic processing section 30 and an image processing

[2] As stated by the applicants during the prosecution history of the '415 patent, "a practitioner of image science (i.e. one of ordinary skill in the arts which encompass the field of the Applicants' present invention) … would at a minimum be familiar with color science … and the concepts and formalism of describing color and tone reproduction." Ex. 2, FH000133-134. "Further, the practitioner of image science would be familiar with the concepts of spatial micro image structure and processing." *Id.* at FH000134.

section 32. *Id.,* 3:33-35. The characteristic processing section 30 produces image processing data 17 in response to color source characteristic information 14, spatial source characteristic information 12, color destination device characteristic information 22 and spatial destination device characteristic information 20. *Id.,* 3:35-40. In turn, the image processing section 32 produces a processed image signal 18 in response to the image processing parameter data 17, an input image signal 16 and a second control signal 19 from the controller 4. *Id.,* 3:41-44.

Figures 1 and 2, and their accompanying text, amply demonstrate that the claimed invention is not to some disembodied abstract idea but is instead a specific application of apparatuses and methods implemented in connection with digital image processing systems.

As described in the specification, in order to correct for distortions caused by elements within the digital image processing system, "an *integral part of the design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices* to ameliorate these distortions." Ex. 1, 1:36-40; Cannizzo Declaration, ¶ 7. This occurs *in a digital processing system*. As stated in the specification, "[t]he device profile is generated … within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device." Ex. 1; 2:18-22; Cannizzo Declaration, ¶ 8. Further, the specification states that, "it is a primary object of the present invention to apply a device independent paradigm to spatial processing *in a digital image processing system*." Ex. 1, 2:4-7; Cannizzo Declaration, ¶ 9. Moreover, the preambles to claims 1 and 26 each explicitly states that the claimed invention comprises "[a] device profile for describing properties of a *device in a digital image reproduction system,*"

and the preamble to claim 10 explicitly states that the claimed invention comprises "[a] method of generating a device profile that describes properties of a device in a digital image reproduction system.

As to the device profile of the claimed invention tangibly existing as a "tag" appended to a digital image obtained using a digital image processing system, the '415 specification states, *inter alia,* that "[t]he characterization of a device's image pixel data in device independent color space is commonly codified in a *tagged file structure, referred to as a device profile, that accompanies the digital imaging device*." *Id., 1*:64-2:1; Cannizzo Declaration, ¶ 10. As further stated in the specification, "[i]n the present invention, spatial characteristic functions are incorporated into device profiles… *coded as* private *tags.* Ex. 1, 5:11-15; Cannizzo Declaration, ¶ __. Further, the specification states that, "it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system" comprising "capture [of] the spatial characterization of the imaging device in a *tagged file format*, referred to as a device spatial profile." *Id., 2*:4-9; Cannizzo Declaration, ¶ 11. In the art and context of the '415 patent, one of ordinary skill in the art would understand that a "tag" described in the specification exists within or attached to a digital image. Cannizzo Declaration, ¶ 13.[3]

D. The "Device Profile" Claims are Not Abstract Ideas.

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[3] For example, various technical dictionary definitions note that a "tag" is used to "label" or . *See, e.g.,* Ex. 5, IEEE 100 – The Authoritative Dictionary of IEEE Standards Terms (7th Ed. 2000) (tag: "same as label"; label: "one or more characters within or attached to a set of data, that identify or describe the data"); Ex. 6, (tag: "same as label"; label: "one or more characters within or attached to a set of data, that contain information about the set…").

As noted in Section III.C. above, a "device profile" is both (1) an *integral* part of the *design and calibration* of a *processor* device within a digital image processing system; and (2) a "tag" appended to or embedded in a digital image obtained using a digital image processing system. Nothing about claims 1 or 26, taken as a whole (which defendants neglect), or even focusing on "device profile" constitutes claiming an "abstract idea itself." *See Ultramercial,* 2013 WL 3111303, *7. Defendants have failed to identify the "abstract idea" that they accuse the claim of being (which alone should be grounds for denying their motion), but whatever that alleged "abstract idea" is, it necessarily has meaningful limitations. For example, claim 1 has the meaningful limitations of (1) a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image; (2) first data for describing a device dependent transformation of color information content of the image (3) to a device independent color space; and (4) second data for describing a device dependent transformation of spatial information content of the image (5) in said device independent color space. Claim 26 is similar a except that it focuses upon "data for describing a device dependent transformation of spatial information content of the image to a device independent color space," and additional upon, "wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions." Due to at least the foregoing "meaningful limitations," the claims do not "merely describe[] an abstract idea or simply add[] 'apply it' and they provide real, specific direction to what is covered. *See Prometheus*, 132 S.Ct. at 1300.

Further, the claims do not cover "all practical applications of an abstract idea.

Ultramercial, 2013 WL 3111303, *10. For example, one of ordinary skill in the art would understand that the '415 claims do not cover all practical applications of digital image processing or device profiles. Cannizzo Declaration, ¶ 39. Digital image processing has been taking place for decades by various methods. Cannizzo Declaration, ¶ 40. A person of ordinary skill in the art understands that there are a myriad of methods to accomplish digital image processing, including without using device profiles comprising first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing a device dependent transformation of spatial information content of the image in said device independent color space. Cannizzo Declaration, ¶ 35. For example, the specification notes prior art digital images processing systems and device profiles, Ex. 1, 1:13 – 2:3 & 5:10-15, and the prosecution history discusses multiple digital imaging prior art device profiles as well. Cannizzo Declaration, ¶ 35; Ex. 2, pp. FH000045-50; 63-66, 79-84, 96-101, 119-127 & 188. Such other methods comprise, *inter alia,* device dependent color spaces and device profiles which do not comprise both data for describing a device dependent transformation of color information and a device dependent transformation of spatial information. *See, e.g.,* Claims 1, 10 & 25, and 1;35-2:3. In fact, the USPTO rejected the claims in the '415 patent application five times, thus requiring the patentee to make certain narrowing claim amendments, based upon prior art digital image processing systems and device profiles. *Id.* These five office actions rejecting claims are also strong evidence that the Patent Examiner, presumptively one skilled in the art, found specific direction to what is covered. *See Id.* & *Prometheus*, 132 S.Ct. at

1300. Further, the specification notes that "conventional[]" device profiles and describes how the '415 patent constitutes "improved" methods and apparatuses. Ex. 1, 2:13-18. Finally, one of Polariod's many other U.S. Patents in this art area, which is U.S. Patent No. 5,694,484, pertains to aesthetic device profiles, not to color or spatial profiles, and is an example of non-infringing device profiles and methods for generating device profiles. Cannizzo Declaration, ¶ 36.

For at least the foregoing, reasons, it cannot be said that the claims "cover all possible ways to achieve the provided result." *See Prometheus*, 132 S. Ct. at 1300.

Further, Defendants have not argued, and cannot support, that the claims contain "only insignificant or token pre- or post-solution activity—such as identifying a relevant audience, a category of use, field of use, or technological environment." *See Prometheus*, 132 S. Ct. at 1297–98, 1300–01. To the contrary, at a minimum the "meaningful limitations" outlined above are clearly significant.

Further, the claimed invention for improved correction of distortions in digital images is not abstract because it comprises "specific applications or improvements to technologies in the marketplace" and "functional and palpable applications in the field of computer technology." *See Research Corp*., 627 F.3d at 869 (concluding that invention for digital image halftoning software was not abstract). Including as the specification states, the claims comprise "[a]n improved device profile includes both chromatic characteristic information and spatial characteristic information to predict both color and spatial characteristic functions of an imaging element or device." *Id., 1*:15-17. Thus, it provides a specific, device

independent for correcting "distortions of the color and spatial components of the image data." *Id.*, 1:32-36.

The *Diehr*, *Alappat*, *Abele* and *Research Corp.* cases all reject similar arguments to those made by Defendants, and each strongly supports the patentability of the claimed invention.[4] In fact, the pixel illumination intensity, x-ray, and digital image halftoning technology of *Alappat, Abele* and *Research Corp.*, respectively, is no less "abstract," no less comprising of data or algorithms, and no more patentable than the digital image processing and device profile technology of the '415 patent.

Further, as noted in Section III.C. above, a "device profile" is an *integral* part of the *design and calibration* of a *processor* device within a digital image processing system. In other words, the claims are tied to specific way of doing something with a computer (i.e., a specially programmed processor within a digital imaging system), with such a processor being specific computer the specified digital image processing. *See Ultramercial,* 2013 WL 3111303, *13. *See Bilski II*, 130 S.Ct. at 3227. Thus, there is no abstract idea, including

[4] *See Diehr*, 450 U.S. at 187 ("[T]he respondents here do not seek to patent a mathematical formula. Instead, they seek patent protection for a process of curing synthetic rubber. Their process admittedly employs a well-known mathematical equation, but they do not seek to pre-empt the use of that equation. Rather, they seek only to foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process."); *In re Alappat,* 33 F.3d 1526, 1544 (Fed. Cir. 1994) ("the claimed invention as a whole is directed to a combination of interrelated elements which combine to form a machine for converting discrete waveform data samples into anti-aliased pixel illumination intensity data to be displayed on a display means."); *In re Abele*, 684 F.2d 902 (C.C.P.A.1982) (holding that a claim providing for the electronic transformation of x-ray data, or data "clearly represen[ing] physical and tangible objects," into a particular visual depiction on a display was patentable.); *Research Corp.*, 627 F.3d at 868–69 (concluding that invention for digital image halftoning software was not abstract because it presented "functional and palpable applications in the field of computer technology"). *See also In re Bilski,* 545 F.3d 943, 963 (Fed. Cir. 2008) (affirming that "the transformation [in *Abele*] of [ ] raw data into a particular visual depiction of a physical object on a display was sufficient to render that more narrowly-claimed process patent-eligible.").

because this special purpose computer is part of the solution, being integral to the performance of the method, and it contains an "improvement," *see e.g.* Ex. 1, 2:13-18, over prior digital image processing technology. *Ultramercial,* 2013 WL 3111303, *13. *See SiRF Tech., Inc. v. Int'l Trade Comm'n*, 601 F.3d 1319, 1332–33 (Fed.Cir.2010). A special purpose computer, i.e., a new machine, specially designed to implement a process may be sufficient. *See Alappat*, 33 F.3d at 1544.

E. A "device profile" of the '415 patent is tangible and not abstract.

Defendants' allegation that the "invention amounts to nothing more than adding data derived from mathematical equations to a well-known and existing file structure (i.e., the ICC profile)" is unfounded an unsupported. For example, in the specification, it states that, "[i]n the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format, as described in the ICC Profile Specification." Ex. 1, 5:10-14. One of ordinary skill in the art would understand these words for what they clearly mean, namely, that spatial characteristic functions can be coded as private tags which are "attachable" to something formatted in accordance with the ICC profile specification. Cannizzo Declaration, ¶ 14. One of ordinary skill in the art would not interpret these statements as stating that the device profile of the invention is part of the ICC profile, or that the invention amounts to nothing more than adding data derived from mathematical equations to the ICC profile. *Id.*

Defendants point out that, in a single office action response, the application stated that

the present invention "provides the actual data which the spatial algorithm requires for processing." *See* Ex. 2 at FH000109. However, Defendants have no evidence or argument for what this statement means to one of ordinary skill in the art in context. The context for this statement is that the applicant was distinguishing U.S. Patent No. 5,634,092 to Stokes, which both the examiner and the applicant referred to as "ST2." *See* Ex. 2 at FH000096 & FH000109 – 110; Cannizzo Declaration, ¶ 15-16. As explained by the Applicant, the "ST2 API essentially initiates (i.e., runs, launches, or enables) the various [spatial and color] algorithms." Ex. 2 at FH000109; Cannizzo Declaration, ¶ 16. In contrast, the applicant explained that the "the present invention provides the actual data which the spatial algorithm requires for processing." Ex. 2 at FH000109; Cannizzo Declaration, ¶ 17. In other words, as the applicant further explained, "[t]he present invention's device profile is generated by use of both the measured chromatic and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device." Ex. 2 at FH000110; Cannizzo Declaration, ¶ 18. To one of ordinary skill in the art, the applicant is merely distinguishing ST2, which merely provided a "means for turning a given algorithm on or off," with the present invention, which comprised a device profile generated "within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device." Ex. 2 at FH000110; Cannizzo Declaration, ¶ . Nothing in the forgoing would be understood by one of ordinary skill in the art as stating that the invention is mere data or algorithm, in fact the applicant is distinguishing ST2 which merely involves "launching or enabling a given

algorithm." Ex. 2 at FH000110; Cannizzo Declaration, ¶ 19.

Defendants allege that the claims comprise data and/or algorithms, and that this makes them unpatentable. Doc 64-1, p. 6. Defendants' argument is erroneous. First, the word "comprise" means "includes, but is not limited to."[5] Thus, by Defendants' own admission, a "device profile" is more than mere data or algorithms. Further, the facts (see Section III.C above) are contrary to Defendants oversimplistic characterization of the claims and of "device profile."

Further, the case law does not support Defendants invalidity allegations. *See, e.g., Diehr*, *Alappat*, *Abele* and *Research Corp., supra. See also Bilski II*, 130 S.Ct. at 3230 ("an application of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection," so long as that application would not preempt substantially all uses of the fundamental principle.); *In re Alappat*, 33 F.3d 1526, 1545 (Rader, J., concurring) ("the line of demarcation between a dedicated circuit and a computer algorithm accomplishing the identical task is frequently blurred and is becoming increasingly so as the technology develops. In this field, a software process is often interchangeable with a hardware circuit."); *In re Lowry*, 32 F.3d 1579, 1583–84 (Fed.Cir.1994) (holding that data stored in memory is a physical component of a computer).

The *In re Nuijten* case relied upon by Defendants merely holds that transient propagating forms of signal transmission such as radio broadcasts, electrical signals through

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[5] *See CIAS, Inc. v. Alliance Gaming Corp.,* 504 F.3d 1356, 1360 (Fed.Cir.2007) ("the term 'comprising' is well understood to mean 'including but not limited to'").

a wire, and light pulses through a fiber-optic cable, are not patentable. *In re Nuijten,* 500 F.3d 1346, 1353 & 1357 (Fed. Cir. 2007). Including for the reasons stated in Section III.C above, *Nuijten* is inapplicable to the present claims.

The *In re Warmerdam* case relied upon by Defendants, the Federal Circuit held unpatentable a process for controlling objects so as to avoid collisions because the key steps of "locating' a medial axis" and "creating' a bubble hierarchy" described "nothing more than the manipulation of basic mathematical constructs." *In re Warmerdam*, 33 F.3d 1354, 1359-60 (Fed.Cir.1994). Including for the reasons stated in Section II.C above, *Warmerdam* is inapplicable to the present claims.

Defendants also cite the *Accenture*, *Benson* and *Flook* cases as somehow supporting their allegations. However, including because the claims and patent at issue are far different from those at issue in these cases, and including for the factual reasons set forth in Section III.C above and otherwise herein, none of these cases is on point.

Defendants reference algorithms that *may* be used in connection with preferred embodiments of the claimed invention. One of ordinary skill in the art understands that a "device profile" *may* optionally include algorithms or enumerate algorithms, but that it need not do so. Cannizzo Declaration, ¶ 19. This is also evident from the plain claim language, which does not specify an algorithm.

Defendants allege that "[t]he inventors told the PTO that this included mathematically transforming device dependent R, G, B values into device independent X, Y, Z values using

the following well-known[6] equation for this transformation," and thus, they erroneously conclude that "[t]he 'first data,' therefore, is nothing more than a set of numbers generated by applying a well-known mathematical equation, the paradigmatic abstract idea." Doc. 64-1, p. 9. Defendants' allegations are unfounded and erroneous in multiple respects. First, the conversion of RGB values to XYZ values is put forth as merely an example. One of ordinary skill in the art would appreciate that is possibly one step in a much longer process used in digital imaging devices. Cannizzo Declaration, ¶ 28. One of ordinary skill in the art would appreciate that, if this was all there is to the "first data", digital photos would be in CIEXYZ format, which they are not. Defendants' oversimplified snippets taken out of context make no mention of the process of the transformation from the individual sensor pixels, their filter format (for example the RGGB of the Bayer configuration), the amount of R, G, and B to obtain a "balanced" image, the sensitivity differences of the sensor pixels, changes for any color cast in the optics, white balance changes, etc. Cannizzo Declaration, ¶ 29.

Further, it would be impossible for one of ordinary skill in the art, or for that matter anyone, to mentally calculate either or both of "first data for describing a device dependent transformation of color information content of the image to a device independent color space; and "second data for describing a device dependent transformation of spatial information

[6] Defendants focus on the alleged "well-known" nature of the certain aspects of preferred embodiments of the claimed subject matter is erroneous. "The Supreme Court repeatedly has cautioned against conflating the analysis of the conditions of patentability in the Patent Act with inquiries into patent eligibility." Ultramercial, 2013 WL 3111303*12. See Diehr, 450 U.S. at 190 ("The question therefore of whether a particular invention is novel is wholly apart from whether the invention falls into a category of statutory subject matter." (internal quotation marks omitted)); see also Prometheus, 132 S.Ct. at 1304 (recognizing that "to shift the patent-eligibility inquiry entirely to [§§ 102, 103, and 112] risks creating significantly greater legal uncertainty, while assuming that those sections can do work that they are not equipped to do").

content of the image in said device independent color space." Cannizzo Declaration, ¶ 30.

Engineers and artists at digital imaging companies today spend years and decades honing these processes so that everyday photographers or users of copy machines can produce accurate and non-distorted images approaching what in the past would have been sought only by photographic artists. Cannizzo Declaration, ¶ 31. These processes allow people to focus on the subject matter, allowing the imaging system to take care of the exposure, color, and spatial details required to capture and transform an image. Cannizzo Declaration, ¶ 31. There is not a single commercial digital imaging system that uses the "simple, abstract methods" suggested by Defendants. Cannizzo Declaration, ¶ 32. Since its inception, digital processing has always needed to deal with getting enough processing power to run the myriad of calculations and processes needed to create pleasing images in constantly changing conditions. Cannizzo Declaration, ¶ 33.

The claims at issue in this case are not highly generalized. Instead, the the specific steps in the claims limit any abstract concept within the scope of the invention. Further, the steps in claims 1, 10 and 26 are not inherent in the idea of digital image processing. Cannizzo Declaration, ¶ 34. One of ordinary skill in the art would understand that there are myriad (albeit generally inferior) way to accomplish the abstract concept of digital image processing that do not require infringing the claims, for example because they do require first data for describing a device dependent transformation of color information content of the image to a device independent color space or second data for describing a device dependent transformation of spatial information content of the image in said device independent color

space. Cannizzo Declaration, ¶ 35.

Further, the claims at in this case comprise generating device profiles for digital image processing, which is not disassociated with any specific application of that apparatus or activity.

By Defendants' flawed logic, since digital images exist in digital form, a digital image (for example, a wedding or graduation photograph) would be "mere data" and just an abstract idea, and a digital image processing system would just be an abstract idea as well, which is absurd.

F. A device profile of the '415 patent is, at a minimum, at least one of a machine, manufacture and/or composition of matter.

Contrary to Defendants arguments otherwise, as set forth in Section III.C above, the device profile of the claimed invention is at least one of a machine, composition or manufacture,[7] including because it comprises (1) an *integral* part a *processor* device within a digital image processing system; and (2) a "tag" appended to or embedded in a digital image obtained using a digital image processing system. There can be no reasonable dispute that a digital imaging system, including the processor therein, and digital images are "concrete things." In other words, the claims of the '415 Patent are tied to a specific machine or apparatus (*i.e.*, a processor device within a digital image processing system). *See In re*

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[7] A "machine" is a "a concrete thing, consisting of parts, or of certain devices and combination of devices." In re Nuijten, 500 F.3d 1346, 1355 (Fed.Cir.2007). a manufacture is "the production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations, whether by hand-labor or machinery." Diamond v. Chakrabarty, 447 U.S. 303, 308, 100 S.Ct. 2204, 65 L.Ed.2d 144 (1980). A "composition of matter" means "all compositions of two or more substances and all composite articles, whether they be results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids." Id.

Ferguson, 558 F.3d 1359, 1363 (Fed. Cir. 2009). Further, even if a "device profile" was limited to data as Defendants' allege, such stored data (for example, in a processing system or tagged to a photo), would at a minimum be a composition of matter.

Defendants' allegation that "[t]he device profile could be data written on a piece of paper" (Doc 64-1, p. 8) is baseless and lacks evidentiary support. One of ordinary skill in the art would understand that many of the characterizations of the device profiles are done "on the fly", such as white balance. Cannizzo Declaration, ¶ 20. Also, the calculations involved with such characterizations are not linear calculations, and they must done in the order of a few milliseconds. Cannizzo Declaration, ¶ 21. Further, every photo has a potentially different profile contents. A manual process for calculating characterizations, even if theoretically possible, would be entirely impractable and unacceptable, Cannizzo Declaration, ¶ 22, including because is an important factor in making a digital imaging system possible. Cannizzo Declaration, ¶ 22.

Further, one of ordinary skill in the art appreciates that some profile contents are pre-programmed into the system or the peripherals. Cannizzo Declaration, ¶ 23. For example, a camera with interchangeable lenses may have characterizations stored on the camera, and the camera may read other characteristics from an attached lens. Cannizzo Declaration, ¶ 23. There are even flash (strobe) systems that interact with the camera, adjusting the width of the projected light based on the zoom level of the lens. Cannizzo Declaration, ¶ 24. The brightness of the flash needs to adjust, since the wider the light, the larger the area the light needs to cover. *Id*. The f-stop might be adjusted to compensate, but in aperture priority mode,

the f-stop is fixed. *Id* . The shutter speed with a flash attached is usually fixed. *Id*. The light from a flash usually has one white balance, but turn the flash off and the ambient light will likely have a different white balance. *Id*. If the f-stop is too wide (smaller f-stop number), the flash may not be able to cover that area. If the flash is off and the exposure becomes too long, noise increases. *Id*. These are just a few examples out of very many. Cannizzo Declaration, ¶ 25. One of ordinary skill in the art would appreciate from even these limited examples that the myriad of variables that go into every photo, and they must be decided in a couple of milliseconds. Cannizzo Declaration, ¶ 26. The results of these decisions are used to not only take the photo, but attached to or embedded in the image (as tags) so the photo can be reproduced on other equipment (printing, monitors, etc.). *Id*.

G. The "Device Profile Generating Claims" are clearly a "process."

As noted above, under § 101 of the Patent Act, "processes" are patentable subject matter. The "Device Profile Generating Claims," *i.e.,* claims 10-15, are directed to various "methods" of generating a specific "device profile" in connection with a digital image processing system. Defendants do not argue that the "method" claims of the '415 patent are not a "process," because clearly they are.[8]

H. The "Device Profile Generating Claims" need not satisfy the machine-or-transformation test, but they satisfy it nonetheless.

Defendants allege that "the Device Profile Generating Claims are properly analyzed under the machine-or-transformation test," and that, "because they fail that test, the asserted claims

[8] See, e.g., Ultramercial, 2013 WL 3111303*13; Research Corp., 627 F.3d 859. See 35 U.SC. § 1100(b) (defining a "process as a "process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material.").

are not a patent eligible" Doc 64-1, p. 11. However, in *Bilski II* the Supreme Court rejected the machine-or-transformation test as being the sole test for patentability of process claims, noting that the machine-or-transformation test is simply "a useful and important clue, an investigative tool, for determining whether some claimed inventions are processes under § 101" and is not "the sole test for deciding whether an invention is a patent-eligible 'process.'" 130 S.Ct. at 3227.

Under the machine-or-transformation test, a process is patent-eligible under §101 if: (1) it is tied to a particular machine or apparatus; or (2) it transforms a particular article into a different state or thing. *CyberSource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1369 (Fed Cir. 2011). In addition, the machine "must impose meaningful limits on the claim's scope." *CyberSource*, 654 F.3d at 1369. In other words, the machine "must play a significant part in permitting the claimed method to be performed." Id. at 1375. Thus, merely applying a computer to a purely mental process or abstract idea does not impose "meaningful limits. *Id.*

The "Device Profile Generating Claims" satisfy the machine prong of this test, including for the reasons set forth in Sections III.C and III.F above. Without limitation, there can be no reasonable dispute that a digital imaging system, including the processor therein, and digital images are "concrete things." In other words, the claims of the '415 Patent are tied to a specific machine or apparatus (*i.e.*, a processor device within a digital image processing system). *See In re Ferguson*, 558 F.3d 1359, 1363 (Fed. Cir. 2009).

Further, the "Device Profile Generating Claims" satisfy the transformation prong of the test, including because the invention described and claimed in the '415 patent involves

"transforming" digital images to ameliorate or help resolve distortions to those images caused by equipment, for example the lens, within a digital image processing system. Cannizzo Declaration, ¶ 7. For example, Claim 10 is directed to a "method of generating a device profile that describes properties of a device in a digital image reproduction system for "transforming or rendering an image." It further comprises "generating first data for describing a device dependent transformation of color information content of the Image" and "generating second data for describing a device dependent transformation of spatial information content of the image. Further, as clearly stated in the specification, the invention of'415 patent is directed to "ameliorate" or even "correct" the "distortions" of the "color and spatial components of the image data" that are caused by the devices, for example "input" and "display" devices, in an image processing system, "so that a processed image can be more accurately captured, transformed or rendered..." Here, Defendants merely re-argue that, "[a]s noted above, the steps of generating first data and second data merely involve assembling the first and second data and indicate the pre-existing data and mathematical relationships used to generate the first and second data without the specification of any machine for doing so." As Plaintiff has already noted above, Defendants' argument is baseless and unsupported. Further, Defendants are making a misleading characterization of the claims. First, in order for the claimed process (or apparatus) to function, there must be an input device, for example a camera, to capture a digital image. *See, e.g,* FIG. 1 and multiple references to "source device 2". Second, the required measurements for generating profile data would need to be done with electronic equipment such as a microdensitometer.

Cannizzo Declaration, ¶ 37. As stated by the applicant during prosecution, "as one skilled in the art would appreciate, the measurement of micro-image properties such as MTF and the Weiner spectrum of noise requires some form of a microdensitometer for analysis (rather than a mouse as suggested by the Office Action) of the developed image." Ex. 2, p. 140. Third, as noted above, the calculations at issue cannot be done on paper or in someone's head. One of ordinary skill in the art would understand that many of the characterizations of the device profiles are done "on the fly", such as white balance. Cannizzo Declaration, ¶ 20. Also, the calculations involved with such characterizations are not linear calculations, and they must done in the order of a few milliseconds. Cannizzo Declaration, ¶ 21. Further, every photo has a potentially different profile contents. A manual process for calculating characterizations, even if theoretically possible, would be entirely impractable and unacceptable, Cannizzo Declaration, ¶ 22, including because is an important factor in making a digital imaging system possible. *Id*. Fourth, in the world full of digital imaging devices, everything "takes measurements and performs mathematical calculations", from digital cameras to copiers to atomic force microscopes, to magnetic resonance imaging, to automotive electronic engine management systems. Cannizzo Declaration, ¶ 38. To suggesting that nothing involving "taking measurements and performing mathematical calculations" is patentable is absurd.

I. The "Device Profile Generating Claims" are not directed to an unpatentable abstract idea.

In order to find the Device Profile Generating Claims of the '415 Patent are directed to

an abstract idea, the Court must find "that this disqualifying characteristic should exhibit itself so manifestly as to override the broad statutory categories of eligible subject matter and the statutory context that directs primary attention on the patentability criteria of the rest of the Patent Act." *Id*. at 868. Here, that is not the case. The Device Profile Generating Claims of the '415 Patent claim a method for using a device profile as part of a digital image processing system – just as the claims in *Research Corp*. were directed to "methods (statutory 'processes') for rendering a halftone image of a digital image….)" *Id*. As set forth in detail above, the device profile of the claimed invention tangibly exists as an *integral* part of the *design and calibration* of a *processor* device in a digital image processing system. Cannizzo Declaration, ¶ 5-6. Defendants vaguely allege that, "[a]s discussed previously, the characteristic functions are merely mathematical formulas." Doc 64-1, p. 11. For the same reasons discussed previously, this allegation is baseless and unsupported.

Defendants also cite the *Bilski I, Cybersource, Grams* and *CLS Bank* cases as somehow supporting their allegations. However, including because the claims and patent at issue are far different from those at issue in these cases, and including for the factual reasons set forth in Section III.C above and otherwise herein, none of these cases is on point.

III. Conclusion.

For the reasons set forth herein, the Court should deny Defendants' motion for summary judgment, including because the asserted claims of the '415 patent are valid because they are directed to statutory subject matter under 35 U.S.C. §101.

Dated: July 10, 2013

Respectfully submitted,

COLLINS, EDMONDS, POGORZELSKI,
SCHLATHER & TOWER, PLLC

/s/ John J. Edmonds
John J. Edmonds
State Bar No. 274200
Stephen F. Schlather
(Admitted *Pro Hac Vice*)

Attorneys for Plaintiff
DIGITECH IMAGE TECHNOLOGIES LLC

PROOF OF SERVICE

The undersigned certifies that counsel of record who are deemed to have consented to electronic service are being served on July 10, 2013 with a copy of this document via the Court's CM/ECF system per the Local Rules. Any other counsel will be served by electronic mail, facsimile, overnight delivery and/or first class mail on this date.

/s/ John J. Edmonds
John J. Edmonds

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) DECLARATION OF JOHN CANNIZZO IN SUPPORT OF PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) DECLARATION OF JOHN CANNIZZO IN SUPPORT OF PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION ET AL.,	CASE NO. SACV 12-01679-ODW (MRWx) DECLARATION OF JOHN CANNIZZO IN SUPPORT OF

Defendant(s).	PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01679-ODW (MRWx) DECLARATION OF JOHN CANNIZZO IN SUPPORT OF PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01679-ODW (MRWx) DECLARATION OF JOHN CANNIZZO IN SUPPORT OF PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

I, John Cannizzo III, declare as follows:

1. I am over the age of 21 and I am competent to testify on the matters set forth herein. The following is based upon my personal knowledge, and if called as a witness I could and would testify competently thereto.

2. I have been engaged by the Plaintiff, Digitech Image Technologies LLC to review U.S. Patent No. 6,128,415 (the "'415 Patent") and the file history of the '415 Patent and to provide certain explanations thereof.

3. I have a Bachelor of Science degree in Computer Science from the University of Southern California. I have worked in the area of computer programming since at least 1978. I have also worked in the field of digital image processing since going to work for Minolta in 1997. After starting with Minolta, I managed several teams in several offices, including teams that created the company's first internally developed print controllers. After Konica and Minolta merged in 2003, the combined companies created a Technology Division to better focus resources in R&D and advanced architectures, and I was appointed as the Director of Advanced Technologies. During my tenure at Konica Minolta, I created several products and created new imaging methods. Under my leadership and with my participation, research was conducted into all facets of trends in the electronics industry and how that could be applied to print imaging. This includes controller architectures and developing new software, firmware, hardware, methods and standards to maintain leading-edge technology position. Additional work was done in medical imaging (microwave imaging of breast tissue for cancer screening, 3D ultrasound, and THz imaging), portable medical sensing devices, microfluidic testing methods (Chem-7, Chem-20, preventative tests for Type-1 diabetes, cancer screening, etc.). My work further involved organic LED, organic photovoltaic, adaptive lighting, energy harvesting, surveillance cameras, digital cameras, and many other areas

for new research and development. While my teams developed many products, I personally developed all hardware and systems-level software, including kernel modifications and drivers. I left Konica Minolta in December 2011, and since then have worked as an independent consultant. My complete cirriculum vitae is attached hereto as Exhibit A.

4. As stated by the applicants during the prosecution history of the '415 Patent, "a practitioner of image science (i.e. one of ordinary skill in the arts which encompass the field of the Applicants' present invention) … would at a minimum be familiar with color science … and the concepts and formalism of describing color and tone reproduction." '415 file history, FH000133-134. "Further, the practitioner of image science would be familiar with the concepts of spatial micro image structure and processing." '415 file history at FH000134. Although I have knowledge and experience beyond a person of ordinary skill in the art, my statements and opinions herein are from the view of a person of ordinary skill in the art, and throughout this declaration when I refer to a person of ordinary skill in the art, I am referring to a person having such qualifications.

5. Based on specification and prosecution history of the '415 Patent, one of ordinary skill in the art would understand that the device profile of the claimed invention tangibly exists as both (1) an integral part of the design and calibration of a processor device within a digital image processing system; and (2) a "tag" appended to or embedded in a digital image obtained using a digital image processing system.

6. The device profile of the claimed invention tangibly exists as an integral part of the design and calibration of a processor device in a digital image processing system. The '415 specification states that an exemplary image processing system includes an "input device," "processor" and "output device. '415 Patent, column 1, lines 19-23 (*i.e.* 1:19-23). This is also illustrated in FIGS. 1 and 2 of the '415 Patent.

7. As described in the specification, in order to correct for distortions caused by elements within the digital image processing system, "an integral part of the design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices to ameliorate these distortions." '415 file history, 1:36-40. This makes clear that the device profile is an integral part of the design and calibration of a processor device in a digital imaging system.

8. The specification of the '415 Patent also states that "[t]he device profile is generated … within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device." '415 file history, 2:18-22. This further demonstrates that the device profile is an integral part of the design and calibration of a processor device in a digital image processing system.

9. Further, the specification states that, "it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system." '415 file history, 2:4-7.

10. The device profile of the claimed invention also tangibly exists as a "tag" appended to a digital image obtained using a digital image processing system. The '415 specification states that "[t]he characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device." '415 Patent, 1:64-2:1.

11. The specification of the '415 Patent further states that "[i]n the present invention, spatial characteristic functions are incorporated into device profiles… coded as private tags. '415 Patent, 5:11-15. This provides additional support that the device profile of the claimed invention also tangibly exists as a "tag" appended to a digital image obtained using a digital image processing system.

12. The specification also states that "it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system" comprising "capture [of] the spatial characterization of the imaging device in a tagged file format, referred to as a device spatial profile." '415 Patent, 2:4-9.

13. In the art and context of the '415 Patent, one of ordinary skill in the art would understand that a "tag" described in the specification exists within or attached to a digital image.

14. A person of ordinary skill in the art would understand these words for what they clearly mean, namely, that spatial characteristic functions can be coded as private tags which are "attachable" to something formatted in accordance with the ICC profile specification.

15. A person of ordinary skill in the art would understand that the statement in the File History of the '415 Patent stating that the invention "provides the actual data which the spatial algorithm requires for processing" was made in the context of distinguishing a certain prior art reference (U.S. Patent No. 5,634,092). '415 file history at FH000109.

16. The Applicants for the '415 Patent described this prior art reference (referred to as "ST2") by stating that "the "ST2 API essentially initiates (i.e., runs, launches, or enables) the various [spatial and color] algorithms." '415 file history at FH000109.

17. The Applicant went on to contrast the invention of the '415 Patent by stating that "the present invention provides the actual data which the spatial algorithm requires for processing." '415 file history at FH000109.

18. The Applicant further explained that "[t]he present invention's device profile is generated by use of both the measured chromatic and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device." '415 file history at FH000110.

19. It would be understood by a person of ordinary skill in the art that the Applicant was distinguishing the invention of the ‘415 Patent over the prior art and not stating that the invention of the ‘415 Patent is only data or is an algorithm. In other words, there is nothing described in Paragraphs 14-17 that would be understood by a person of ordinary skill in the art as describing the invention of the ‘415 Patent as merely data or an algorithm.

20. One of ordinary skill in the art would understand that many of the characterizations of the device profiles are done “on the fly”, such as white balance.

21. The calculations involved with such characterizations are not linear calculations, and they often must done in the order of a few milliseconds.

22. A manual process for calculating characterizations, even if theoretically possible, would be entirely impractical and unacceptable at least because this calculation speed is an important factor in making a digital imaging system possible.

23. One of ordinary skill in the art would appreciate that some profile contents are pre-programmed into the system or the peripherals. One example of this would be a camera with interchangeable lenses which may have characterizations stored on the camera, where the camera may read other characteristics from the attached lens.

24. In addition, flash (strobe) systems exist that interact with the camera, adjusting the width of the projected light based on the zoom level of the lens. With such flash systems, the brightness of the flash needs to adjust, since the wider the light, the larger the area the light needs to cover. The f-stop might be adjusted to compensate, but in aperture priority mode, the f-stop is fixed. The shutter speed with a flash attached is usually fixed. The light from a flash usually has one white balance; however, if the flash is turned off the ambient light will likely have a different white balance. Alternatively, if the f-stop is too wide (i.e., smaller f-stop number), the flash may not be able to cover that area. If the flash is off and the exposure becomes too long, noise increases.

25. A person of ordinary skill in the art would be aware of numerous other examples in which calculations related to device profiles could not possibly or practically be done by hand.

26. Even based on the examples above, a person of ordinary skill in the art would appreciate the myriad of variables that go into every photo or copy, and they must be decided in a couple of milliseconds. The results of these calculations are used to not only take the photo, but attached to or embedded in the image (as tags) so the photo can be reproduced on other equipment (printing, monitors, etc.).

27. In the context of the '415 Patent and its prosecution history, one of ordinary skill in the art would understand the reference to "abstract description" as referring to the device profile of the '415 Patent and not, unlike Ohtsuka, being tied to a particular device. This interpretation is supported by the Applicant's statement that "In contrast, to be general enough for all devices and image processing operations, the present invention requires noise and sharpness descriptions that are not tied to any particular technology. The value of such general requirements of the present invention is neither disclosed nor suggested by Ohtsuka, or the applied prior art." '415 File History at FH000113.

28. A person of ordinary skill in the art reading the '415 Patent would understand that the conversion of RGB values to XYZ values is put forth as merely an example. One of ordinary skill in the art would appreciate that may also be but one step in a much longer process used in digital imaging devices.

29. One of ordinary skill in the art would also appreciate that, if this was all there is to the "first data", digital photos would be in CIEXYZ format, which they are not.

30. It would be impossible for a person of ordinary skill in the art, or for that matter anyone, to mentally calculate either or both of "first data for describing a device dependent transformation of color information content of the image to a device independent color space; and "second data for describing a device dependent transformation of spatial information content of the image in said device independent color space."

31. Engineers and artists at digital imaging companies today spend years and decades honing these processes so that everyday photographers or users of copy machines can produce accurate and non-distorted images approaching what in the past would have been sought only by photographic artists. These processes allow people to focus on the subject matter, allowing the imaging system to take care of the exposure, color, and spatial details required to capture and transform an image.

32. There is not a single commercial digital imaging system that uses the "simple, abstract methods" suggested by Defendants in their Motion for Summary Judgment.

33. Since its inception, digital processing has always needed to deal with getting enough processing power to run the myriad of calculations and processes needed to create pleasing images in constantly changing conditions.

34. Further, to one of ordinary skill in the art, the limitations in claims 1, 10 and 26 are not inherent in the idea of digital image processing, which is a broad and diverse field which is much, much broader than the claimed invention.

35. A person of ordinary skill in the art understands that there are a myriad of methods to accomplish digital image processing, including without using device profiles comprising first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing a device dependent transformation of spatial information content of the image in said device independent color space. For example,

the specification notes prior art digital image processing systems and device profiles '415 Patent, 1:13 – 2:3 & 5:10-15), and the prosecution history discusses multiple digital imaging prior art device profiles as well. '415 file history, pp. 45-50; 63-66, 79-84, 96-101, 119-127 & 188.

36. One of Polariod's many other U.S. Patents in this art area, which is U.S. Patent No. 5,694,484, pertains to aesthetic device profiles, not to color or spatial profiles, and is an example of non-infringing device profiles and methods for generating device profiles.

37. The required measurements for generating profile data would need to be done with electronic equipment such as a microdensitometer.

38. In the world full of digital imaging devices, everything "takes measurements and performs mathematical calculations," from digital cameras to copiers to atomic force microscopes, to magnetic resonance imaging, to automotive electronic engine management systems.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge, professional opinions and beliefs.

Executed on July 10, 2013 in California.

John Cannizzo III

the specification notes prior art digital image processing systems and device profiles '415 Patent, 1:13 – 2:3 & 5:10-15), and the prosecution history discusses multiple digital imaging prior art device profiles as well. '415 file history, pp. 45-50; 63-66, 79-84, 96-101, 119-127 & 188.

36. One of Polariod's many other U.S. Patents in this art area, which is U.S. Patent No. 5,694,484, pertains to aesthetic device profiles, not to color or spatial profiles, and is an example of non-infringing device profiles and methods for generating device profiles.

37. The required measurements for generating profile data would need to be done with electronic equipment such as a microdensitometer.

38. In the world full of digital imaging devices, everything "takes measurements and performs mathematical calculations," from digital cameras to copiers to atomic force microscopes, to magnetic resonance imaging, to automotive electronic engine management systems.

39. One of ordinary skill in the art would understand that the '415 claims do not cover all practical applications of digital image processing or device profiles.

40. Digital image processing has been taking place for decades by various methods.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge, professional opinions and beliefs.

Executed on July 10, 2013 in Huntington Beach, California.

John Cannizzo III

EXHIBIT A
TO DECLARATION OF JOHN CANNIZZO

R E S U M E

JOHN CANNIZZO III
16967 Edgewater Lane
Huntington Beach, CA. 92649

Telephone: (714) 313-9482
Facsimile: (714) 960-4262
EMail: johnc@avantiholdings.com

E D U C A T I O N

UNIVERSITY OF SOUTHERN CALIFORNIA
Los Angeles, CA.

B.S. - Computer Science
B.S. - Biology
Ph.D. (Honorary)
Biochemistry

P R O F E S S I O N A L T R A I N I N G

Data General - Eclipse Assembler (1980), Data General - AOS Systems Programmer (1980), Digital Equipment Corporation - Macro-11 with VAX/VMS (1980), Digital Equipment Corporation - Fortran/Macro Programmer - VAX/VMS (1980), Data General - AOS & AOS/VS Internals (1983), TKC - Noise Aspects of Applying Advanced CMOS Semiconductors (1989), TKC - Design for Electrostatic Discharge and Radio Frequency Interference (1989), TKC - High Speed Logic Design for RFI (1989), TKC - Digital Design for Interference Specifications, FCC & VDE (1989). Certification for Import/Export Administrators, U.S. Dept. of Commerce (1992).

P R O F E S S I O N A L A F F I L I A T I O N S

Co-founder and former President of the PCMCIA Standards Committee, Advisor to the IRDA Committee, Member JEDEC, Member IEEE, Member ACM.

E M P L O Y M E N T H I S T O R Y

Konica Minolta Technology USA — January '97 – December '11
Huntington Beach, CA — Director of Advanced Technologies

After Konica and Minolta merged in 2003, the combined companies created a Technology Division to better focus resources in R&D and advanced architectures. After starting with Minolta, I managed several teams internationally in several offices. Personally managed teams that created the company's first internally developed print controllers, the company's I/O subsystem including network protocol stacks, RS-232, IEEE1284, IEEE1394, Ethernet, and USB stacks. Created all network security protocols, management (SNMP), email protocols, IFAX, Internet FAX, compression standards, and standards committees. Negotiated many worldwide contracts with vendors, cutting per-unit costs by over 1000%. Advised on company acquisitions and long-term strategic planning. Created several products, and created advanced architectures including parallel processing, new imaging methods, and forming strategic relationships to further advance competitive edge. Ongoing research is conducted into all facets of trends in the electronics industry and how that could be applied to print imaging. This includes nanotechnology, parallel processing, CPU trends, DSP uses, controller architectures, bandwidth and buss issues, scanned image correction (for MFPs), wired and wireless communication, and develop new software, firmware, hardware, methods and standards to maintain leading-edge technology position. Additional work was done in medical imaging (microwave imaging of breast tissue for cancer screening, 3D ultrasound, and THz

imaging), portable medical sensing devices, microfluidic testing methods (Chem-7, Chem-20, preventative tests for Type-1 diabetes, cancer screening, etc.). Work in organic LED, organic photovoltaic, adaptive lighting, energy harvesting, surveillance cameras, digital cameras, and many other areas for new research and development. Performed all facets of embedded computing architectures including multicore, low-power, consumer electronics, embedded operating systems, firmware, and software. While my teams developed many products, I personally developed all hardware and systems-level software, including kernel modifications and drivers.

Avanti Technologies Jan '95 – Present
Huntington Beach, CA President

A consulting and research & development firm specializing in advanced technologies and future products. Consulted for many Fortune 1000 companies internationally and created many technologies and products for those companies. Also created several concepts currently in the venture funding stages. Intellectual Property (IP) consulting in all aspects of the patent process, including valuations and litigation. Hardware, firmware, systems software, and applications software were all created for many platforms including portables and cell phones. Multiple applications in Apple's App Store. Various assembly languages, C, C++, C#, Fortran, Pascal, BASIC, php, XML, Java, many app framworks, etc.

Nimble Computer Corporation Jul '91 – Jan '95
Huntington Beach, CA President

A venture capital funded company started for the purpose of creating a fully DOS/Windows/Windows 95 compatible handheld computer with handwriting recognition, a cellular telephone/FAX/modem/pager, infrared communication and two PCMCIA slots. Acted as CEO, President, CFO and VP Engineering. Authored the company's cursive handwriting recognition engine and did all electrical (digital and analog), mechanical and software engineering. Product weighed one pound while providing TFT color backlit LCD, two separate PCMCIA slots (Type III & Type II), touch screen, handwriting recognition, sound, IRDA, and full PC functionality with docking. Also supported full communications including cellular and wired voice, FAX & modem using integrated speaker and microphone, and could send and receive streaming video and sound. Unit was only 3/4" thick and used 4 AA batteries.

Citizen Systems, Inc. Nov '87 - Nov '89
Santa Monica, CA. Director of Engineering and Product Planning

Responsible for product design, engineering and marketing for new intelligent products for the U.S. and European (East and West) markets. Managed all business areas; personnel, marketing, sales, for several computer, printer, and peripheral projects.

CompuSystems Technologies May '83 to present
Huntington Beach, CA. Consultant

Consulting (hardware, software, management & marketing), project management and product planning. Ability to meld management, finance, marketing and engineering functions to provide complete services to the technical customer/company. Designed several computer & intelligent hardware and software products worldwide; including embedded systems, portable electronics & computers, BIOS, VxDs, NT device drivers, commercial software, graphics systems, pen-based computing, handwriting recognition and DirectX applications. With over 15 years consulting experience, the individual projects are too numerous to list; details provided upon request.

Hamburger Hamlets, Inc. Jul '81 - Apr '83
Beverly Hills, CA. Systems Manager

A national restaurant chain, was responsible for hardware and software management, point-of-sale computers, menu planning/costing, and training chefs, bartenders and wine servers.

Vidal Sassoon, Inc. Nov '80 - Jul '81
Century City, CA. Prog/Analyst

Systems programmer and analyst.

Volt Delta Resources Aug '80 - Nov '80
Anaheim, CA. Systems Programmer

Systems programmer on the DAS/C Directory Assistance System for telephone companies.

McDonnell-Douglas Automation, Inc. Aug '79 - Aug '80
Cypress, CA. Systems Programmer

Systems and graphics programming, management (45 people), other projects (classified).

University of Southern California Sep '78 - Jun '79
Los Angeles, Ca. Teaching

Taught classes in BASIC, FORTRAN, C and Pascal to Computer Science and Business majors.

Personal references available upon request.

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) DECLARATION OF JOHN EDMONDS IN SUPPORT OF PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) DECLARATION OF JOHN EDMONDS IN SUPPORT OF PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION ET AL.,	CASE NO. SACV 12-01679-ODW (MRWx) DECLARATION OF JOHN EDMONDS IN SUPPORT OF

Defendant(s).	PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01679-ODW (MRWx) DECLARATION OF JOHN EDMONDS IN SUPPORT OF PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01679-ODW (MRWx) DECLARATION OF JOHN EDMONDS IN SUPPORT OF PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

I, John J. Edmonds, declare as follows:

1. I am over the age of 21 and I am competent to testify on the matters set forth herein. I am an attorney with the law firm of Collins, Edmonds, Pogorzelski, Schlather & Tower, PLLC, counsel for Plaintiff Digitech Image Technologies LLC in this matter. The following is based upon my personal knowledge, and if called as a witness I could and would testify competently thereto.

2. Exhibit 1 to PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101 ("Plaintiff's Response") is a true and correct copy of U.S. Patent No. 6,128,415 (the '415 Patent).

3. Exhibit 2 to Plaintiff's Response is a true and correct copy of the prosecution history for the '415 Patent.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on July 10, 2013 in Houston, Texas.

John J. Edmonds

US006128415A

United States Patent [19]

Hultgren, III et al.

[11] Patent Number: 6,128,415

[45] Date of Patent: *Oct. 3, 2000

[54] **DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM**

[75] Inventors: **Bror O. Hultgren, III**, Ipswich; **F. Richard Cottrell**, Easton; **Jay E. Thornton**, Watertown, all of Mass.

[73] Assignee: **Polaroid Corporation**, Cambridge, Mass.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/709,487**

[22] Filed: **Sep. 6, 1996**

[51] **Int. Cl.**[7] **G06K 9/00**; G06K 9/36; G03F 3/08; G03F 3/10

[52] **U.S. Cl.** **382/276**; 382/162; 382/167; 382/266; 345/431; 358/518; 358/527

[58] **Field of Search** 382/167, 276, 382/266, 239, 162; 358/518, 527, 520; 345/418, 431

[56] **References Cited**

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5,668,890	9/1997	Winkelman	382/167
5,682,442	10/1997	Johnston et al.	382/239
5,694,484	12/1997	Cottrell et al.	382/167
5,838,333	11/1998	Matsuo	345/431
5,881,209	3/1999	Stokes	358/504

OTHER PUBLICATIONS

Murch "New Paradigms for Visualization," IEEE. pp. 550–551, 1990.

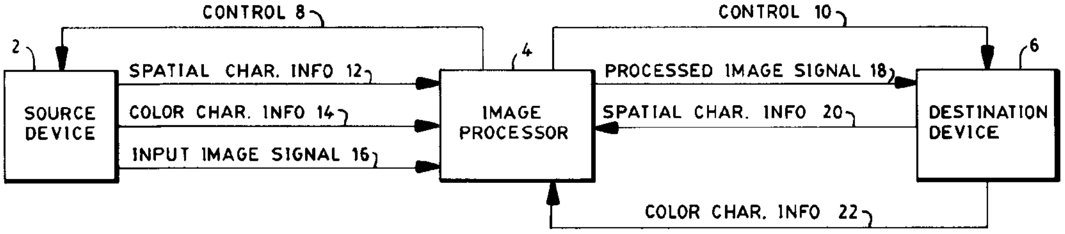
ICC Profile Format Specification, Version 3.10b, Oct. 21, 1995.

Primary Examiner—Andrew J. Johns
Assistant Examiner—Daniel G. Mariam
Attorney, Agent, or Firm—Robert J. Decker

[57] **ABSTRACT**

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

33 Claims, 3 Drawing Sheets



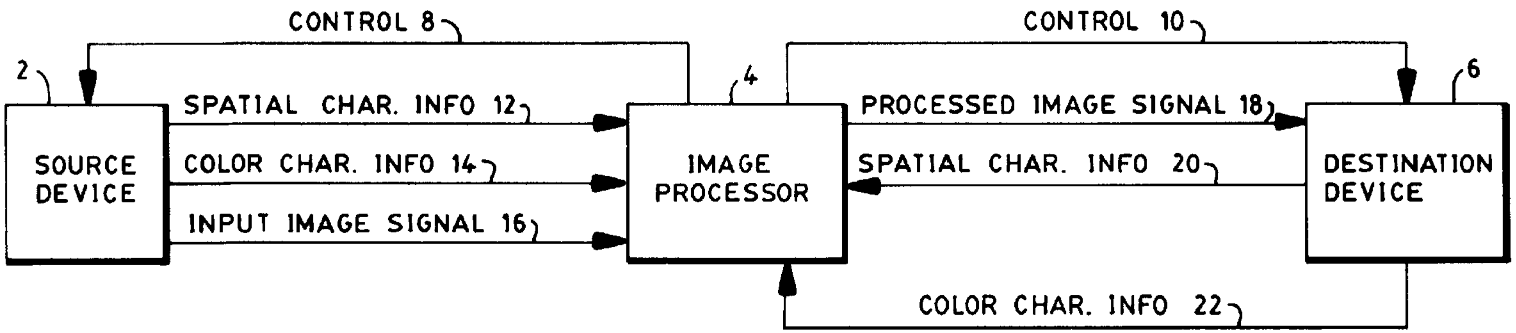

CONTROL 8
CONTROL 10
2
4
6
SOURCE DEVICE
IMAGE PROCESSOR
DESTINATION DEVICE
SPATIAL CHAR. INFO 12
COLOR CHAR. INFO 14
INPUT IMAGE SIGNAL 16
PROCESSED IMAGE SIGNAL 18
SPATIAL CHAR. INFO 20
COLOR CHAR. INFO 22

FIG. 1

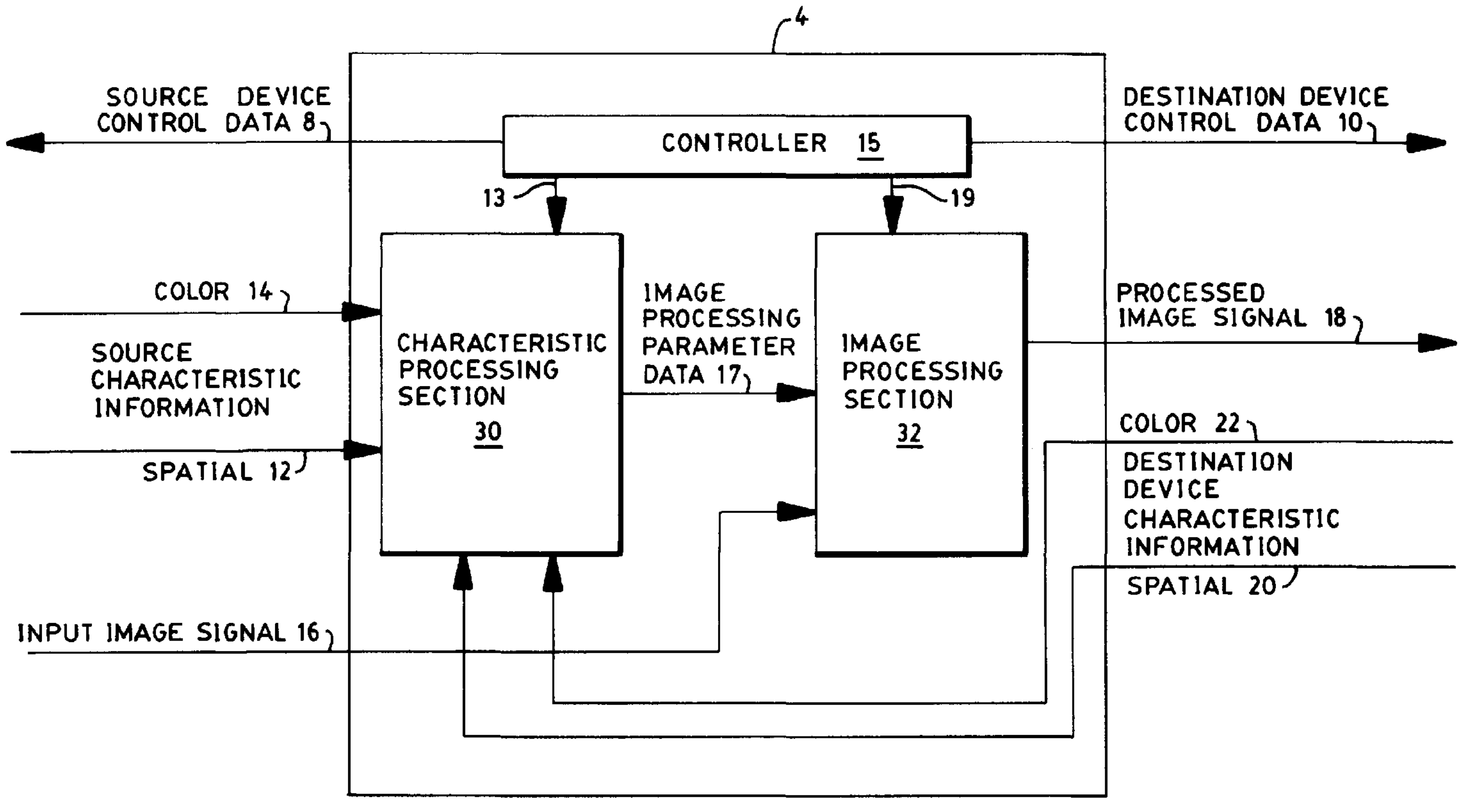

4
SOURCE DEVICE CONTROL DATA 8
CONTROLLER 15
DESTINATION DEVICE CONTROL DATA 10
13
19
COLOR 14
SOURCE CHARACTERISTIC INFORMATION
SPATIAL 12
CHARACTERISTIC PROCESSING SECTION 30
IMAGE PROCESSING PARAMETER DATA 17
IMAGE PROCESSING SECTION 32
PROCESSED IMAGE SIGNAL 18
COLOR 22
DESTINATION DEVICE CHARACTERISTIC INFORMATION
SPATIAL 20
INPUT IMAGE SIGNAL 16

FIG. 2

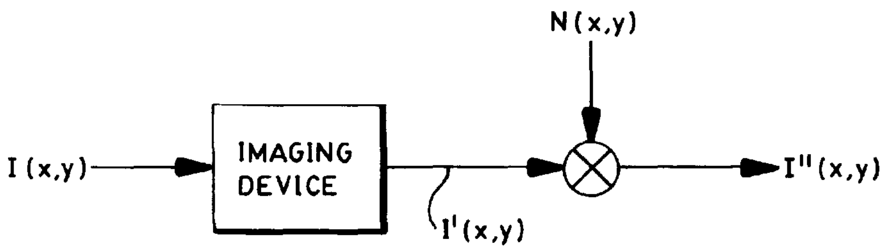

N(x,y)
I(x,y)
IMAGING DEVICE
I'(x,y)
I''(x,y)

FIG. 3

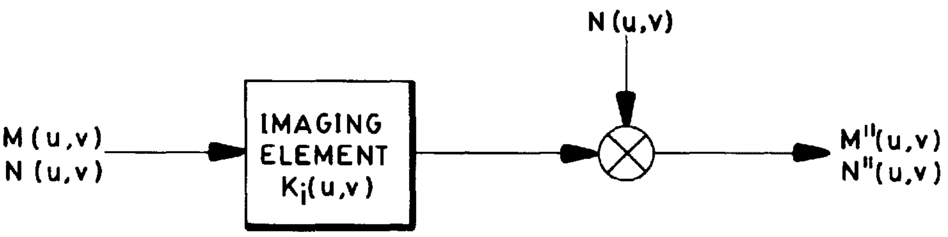

N(u,v)
M(u,v)
N(u,v)
IMAGING ELEMENT
$K_i(u,v)$
M''(u,v)
N''(u,v)

FIG. 4

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed generally towards digital image processing and more specifically towards generation and use of an improved device profile for describing both spatial and color properties of a device within an image processing system, so that a processed image can be more accurately captured, transformed or rendered.

2. Description of the Prior Art

Digital image processing involves electronically capturing an image of a scene, altering the captured image in some desired fashion and passing the altered image to an output device. An upstream element of a digital image processing system can be thought of as a source device, whereas a downstream element can be thought of as a destination device. For instance, a simple image processing system could include an acquisition device such as a digital camera, camcorder, scanner, CCD, etc., a color processor for processing the colors of the image, and an output device, such as a printer, monitor, computer memory, etc. When considering a communication between the acquisition device and the color processor, the acquisition device is deemed as the source device whereas the color processor is deemed as the destination device. When considering a communication between the color processor and the output device, the color processor is deemed as the source device whereas the output device is deemed as the destination device.

All imaging devices, either image acquisition or image display, will impose distortions of the color and spatial components of the image data.

Historically, industry has chosen to correct these distortions with device dependent solutions. It is common practice in the industry that an integral part of the design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices to ameliorate these distortions. For example, electronic peaking filters are often employed in video capture devices to correct for the blurring effects of anti-aliasing filters and amplifier frequency response. Electronic imaging devices are commonly designed to function with specific upstream (in the case of display devices) or downstream (in the case of image sources) devices to provide quality images. For example, image capture devices commonly transform the image digits to compensate ('gamma corrected') for the CRT volts-luminance characteristics of CRT displays. Such design considerations provide a device dependent model for that specific implementation of an image processing system, but do not provide the same degree of image quality when substituting an alternative device.

Recently, device independent paradigms for the characterization of color information in an image processing system have been developed and are being implemented: Color Sync, developed by Apple Computer and KCMS, developed by Eastman Kodak Co., are examples of systems or components supporting a device independent color paradigm. This paradigm is based upon a characterization of the image pixel data (digits) in a device independent color space—e.g. CIE L*a*b* or CIE XYZ, and the use of a Color Management System. The characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device. However, the spatial characteristics of digital imaging devices are still modified in the context of the device dependent model described above.

In order to improve processing flexibility and versatility, it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system. This paradigm will capture the spatial characterization of the imaging device in a tagged file format, referred to as a device spatial profile.

SUMMARY OF THE INVENTION

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured chromatic response and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned aspects and other features of the invention are described in detail in conjunction with the accompanying drawings in which the same reference numerals are used throughout for denoting corresponding elements and wherein:

FIG. **1** is a block diagram of a basic digital image processing system according to the invention;

FIG. **2** is a detailed block diagram of the image processor of FIG. **1**;

FIG. **3** is a model of characteristic functions sufficient to reconstruct signal and noise power distributions for linear, stationary image systems having additive noise; and

FIG. **4** is a model of the effect of an image processing element upon an image.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A simplified version of a digital image processing system is shown in the block diagram of FIG. **1**. The acquisition device **2**, for instance a digital camera, acquires an image which is represented as the input image signal **16**. The image processor **4** receives the input image signal **16**, acquisition device spatial characteristic information **12** and acquisition device color characteristic information **14** in response to a control signal **8**. The image processor **4** also receives output device spatial characteristic information **20** and output device color characteristic information **22** from the output device **6** in response to a control signal **10**. After processing the input image signal **16** in accordance with all the signals received by the processor **4**, the image processor **4** sends the processed image signal **18** to output device **6**, for instance a printer which produces a hardcopy of the processed image.

An image includes both spatial and chromatic information. The spatial content of an image can be described by its signal and noise power distributions. An image's signal or noise power distribution will be transformed by a device but

does not give an unique description of the device because the distributions are image specific and they will be determined by the result of all preceding image transformations. However for one class of imaging devices namely linear, stationary imaging systems with additive noise, characteristic functions sufficient to reconstruct the signal and noise power distributions can be constructed. In practice many systems not conforming to these conditions can be approximated as linear, stationary imaging systems with additive noise having sufficient accuracy to enable the prediction of perceived image quality if not full image reconstruction.

Spatial characteristics of the elements of an image processing system or platform can be represented in at least two forms. In a first form, a characteristic processing section **30** of the image processing platform contains spatial characteristic functions describing added noise and image signal transform characteristics of the source and destination devices. In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, the characteristic processing section **30** contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. patent application Ser. No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation. This patent application is hereby incorporated in its entirety to provide supplemental background information which is non-essential but helpful in appreciating the applications of the present invention.

FIG. **2** is a detailed diagram of the image processor **4** of FIG. **1**. The image processor **4** includes a controller **15**, a characteristic processing section **30** and an image processing section **32**. The characteristic processing section **30** produces image processing data **17** in response to color source characteristic information **14**, spatial source characteristic information **12**, color destination device characteristic information **22**, spatial destination device characteristic information **20**, and a first control signal **13** from the controller **15**. In turn, the image processing section **32** produces a processed image signal **18** in response to the image processing parameter data **17**, an input image signal **16** and a second control signal **19** from the controller **4**. The controller **15** also generates both source device control data **8** and destination device control data **10**.

If I(x,y) represents the intensity distribution over the spatial coordinates (x,y) of the image and I(u,v) represents the corresponding frequency domain representation of the image constructed from the Fourier transform of I(x,y), then the transformation of the image by a linear, stationary imaging element can be represented as shown in FIG. **3**. In the spatial domain the transformation is described by a Linear function S(g(x,y)):

$$I'(x,y)=S(I(x,y)) \tag{1}$$

$$I''(x,y)=S(I(x,y)+N(x,y)) \tag{2}$$

and in the Fourier (spatial frequency) domain by the Fourier Transform S(G(u,u)) of S(g(x,y)):

$$I(u,v)=S(I(u,v)) \tag{3}$$

$$I''(u,v)=S(I(u,v)+N(u,v)) \tag{4}$$

where N(x,y) and its corresponding Fourier Transform N(u,v) represents the additive noise.

For a linear, stationary imaging system, the transfer function S(g(x,y)) is given by

$$S(g(x,y))=s(x,y)\otimes g(x,y) \tag{5}$$

where ⓧ signifies convolution. S(G(u,v) is given by:

$$S(G(u,v))=S(u,v)*G(u,v) \tag{6}$$

where * signifies point multiplication.

In principle S(u,v) can be computed from the ratio of the output/input signal power distributions. In practice, S(u,v) is determined from fourier analysis of images of step input images via edge gradient analysis, or point or line images via point or line spread analysis. The transfer function is commonly called the Modulation Transfer Function (MTF).

If the input image is an uniform image $I(x,y)=I_0$, Fourier analysis of the output image will yield the Wiener Noise Power Spectrum N(u,v) which is the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

As stated previously, most real systems violate the criteria for being linear and stationary; and while introducing additive noise, that noise is often gray level dependent. This type of noise is referred to as non-linear, non-stationary, gray level dependent additive noise.

If a number of uniform field images, each described by a constant intensity I_y (where Y represents the luminance level) are processed by a device, Fourier analysis of the output images will yield Wiener Noise Power Spectra $N_y(u,v)$. The set of gray level dependent Wiener Noise Power Spectra represents the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

For non-linear image transforms a set of signal level dependent MTFs could, in principle, be generated to represent the characteristic functions describing the signal transform in the imaging device. In practice a single characteristic function can be generated from an ensemble average of MTFs or a small signal approximation. In general all of these characteristic functions are two-dimensional functions which are represented as M(u,v).

For non-stationary image transforms the image signal transform characteristic function can, in principle, be represented by a multi-dimensional function, M(x,y,u,v), generated from a local fourier analysis of the point spread function located at the position (x,y). In practice the characteristic function can be approximated by an ensemble average of the position dependent multi-dimensional function M(x,y,u,v).

$$M(u,v)=<M(x,y,u,v)>_{xy} \tag{7}$$

where the operation $<M(x,y,u,v)>_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y.

The processing of spatial characteristic functions in the image processing system of the preferred embodiment is model based. For a linear imaging system with additive noise, each image processing element is represented by a transfer function that is a model of the effect of that image processing element upon an image as shown in FIG. **4** and defined by equations (7) and (8) in the frequency domain.

$$M''(u,v)=Ki(u,v)*M(u,v) \tag{8}$$

$$N''(u,v)=Ki^2(u,v)*N(u,v)+Ni(u,v) \tag{9}$$

For non-linear imaging elements, the transfer function may be a more general representation of the characteristic func-

tions presented to the imaging element and evaluated in terms of a model of the imaging element.

Spatial characteristic functions are generated from fourier analysis of selected target images. Characteristic functions (a) may be scalar, one or two dimensional arrays for at least one of the device N channels, (b) are evaluated over the spatial frequency range 0 to the Nyquist frequency in equal frequency intervals, and (c) for source devices may be stated either in a proprietary processing space or in device independent space.

In the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format, as described in the ICC Profile Specification, version 3. 10b dated Oct. 21, 1995. The tagged format should include information as to which class the particular characteristic function belongs, i.e. Modulation Transfer Functions, Wiener Noise Power Spectra, or gray level dependent Wiener noise masks. The tagged format should also include information sufficient to identify both the relevant units of spatial frequency and the dimensionality of the characteristic functions. Propagation of characteristic functions is calculated within the context of the model based image processing system.

It is to be understood that the above described embodiments are merely illustrative of the present invention and represent a limited number of the possible specific embodiments that can provide applications of the principles of the invention. Numerous and varied other arrangements may be readily devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention as claimed.

What is claimed is:

1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.

2. The device profile of claim **1** wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

3. The device profile of claim **2**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

4. The device profile of claim **1**, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

5. The device profile of claim **1**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

6. The device profile of claim **5**, wherein said gray level dependent additive noise is spatially dependent.

7. The device profile of claim **1**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

8. The device profile of claim **7**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

9. The device profile of claim **1** wherein, for said device, the second data is generated through use of spatial stimuli and device response characteristic functions.

10. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;

generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and

combining said first and second data into the device profile.

11. The method of claim **10** wherein, for said device:

said second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

12. The method of claim **11** wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

13. The method of claim **11** wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

14. The method of claim **11**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

15. The method of claim **13**, wherein said gray level dependent additive noise is spatially dependent.

16. The method of claim **11**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

17. The method of claim **16**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

18. A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space through use of chromatic response characteristic functions; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device independent color space through the use of spatial characteristic fimctions describing image spatial transform characteristics in said device independent color space.

19. The system of claim **18**, wherein the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

20. The system of claim **19**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

21. The system of claim **18**, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

22. The system of claim **18**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

23. The system of claim **22**, wherein said gray level dependent additive noise is spatially dependent.

24. The system of claim **18**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

25. The system of claim **24**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

26. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

27. The device profile of claim **26** wherein, for said device, the data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

28. The device profile of claim **27**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

29. The device profile of claim **26**, wherein the data is represented by characteristic functions describing a gray level dependent additive noise in said device.

30. The device profile of claim **26**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

31. The device profile of claim **30**, wherein said gray level dependent additive noise is spatially dependent.

32. The device profile of claim **26**, wherein the data is represented by characteristic functions describing spatially dependent additive noise in said device.

33. The device profile of claim **32**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

* * * * *

FILE HISTORY
US 6,128,415

PATENT:	6,128,415
INVENTORS:	Hultgren, III, Bror O. Cottrell, F. Richard Thornton, Jay E.
TITLE:	Device profiles for use in a digital image processing system
APPLICATION NO:	US1996709487A
FILED:	06 SEP 1996
ISSUED:	03 OCT 2000
COMPILED:	30 JAN 2012

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
08/709 487	09/06/96	382	276	~~2716~~ 2721	MARIAM

APPLICANTS: BROR O. HULTGREN III, IPSWICH, MA; F. RICHARD COTTRELL, EASTON, MA; JAY E. THORNTON, WATERTOWN, MA.

CONTINUING DATA*******************
VERIFIED

dQ none

FOREIGN/PCT APPLICATIONS**********
VERIFIED

dQ none [redacted]

FOREIGN FILING LICENSE GRANTED 10/19/96

Foreign priority claimed / 35 USC 119 conditions met / Verified and Acknowledged / Examiner's Initials	AS FILED	STATE OR COUNTRY	SHEETS DRWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
☐ yes ☒ no / ☐ yes ☐ no		MA	3	33	4	$1,070.00	8166(RAS)

~~POLAROID CORPORATION~~
~~PATENT DEPARTMENT~~
~~549 TECHNOLOGY SQUARE~~
~~CAMBRIDGE MA 02139~~

#020349

TITLE: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

U.S. DEPT. of COMMERCE ... PTO-436L (rev. 7-94)

6,128,415

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Transaction History

Date	Transaction Description
9/23/1996	Initial Exam Team nn
10/30/1996	Application Captured on Microfilm
11/15/1996	Case Docketed to Examiner in GAU
11/15/1996	Transfer Inquiry
3/24/1997	Information Disclosure Statement (IDS) Filed
3/24/1997	Information Disclosure Statement (IDS) Filed
5/27/1997	Preliminary Amendment
11/3/1997	Case Docketed to Examiner in GAU
12/8/1997	Non-Final Rejection
12/10/1997	Mail Non-Final Rejection
3/11/1998	Response after Non-Final Action
3/12/1998	Date Forwarded to Examiner
5/26/1998	Final Rejection
6/2/1998	Mail Final Rejection (PTOL - 326)
9/2/1998	Continuing Prosecution Application - Continuation (ACPA)
9/2/1998	Mail Express Abandonment (During Examination)
9/2/1998	Express Abandonment (during Examination)
9/10/1998	Date Forwarded to Examiner
10/1/1998	Non-Final Rejection
10/7/1998	Mail Non-Final Rejection
2/8/1999	Response after Non-Final Action
2/8/1999	Request for Extension of Time - Granted
2/10/1999	Date Forwarded to Examiner
4/12/1999	Non-Final Rejection
4/14/1999	Mail Non-Final Rejection
7/19/1999	Response after Non-Final Action
7/27/1999	Date Forwarded to Examiner
9/24/1999	Mail Final Rejection (PTOL - 326)
9/24/1999	Final Rejection
12/30/1999	Amendment/Argument after Notice of Appeal
12/30/1999	Notice of Appeal Filed
1/20/2000	Examiner Interview Summary Record (PTOL - 413)

1/21/2000	Mail Notice of Allowance
1/21/2000	Notice of Allowance Data Verification Completed
2/23/2000	Workflow - File Sent to Contractor
2/28/2000	Issue Fee Payment Verified
2/28/2000	Workflow - Drawings Finished
2/28/2000	Workflow - Drawings Matched with File at Contractor
2/28/2000	Workflow - Drawings Received at Contractor
2/28/2000	UnMatched Papers in Pubs
2/28/2000	Workflow - Drawings Sent to Contractor
3/28/2000	Workflow - Complete WF Records for Drawings
8/20/2000	Application Is Considered Ready for Issue
9/14/2000	Issue Notification Mailed
10/3/2000	Recordation of Patent Grant Mailed
9/24/2009	Applicant Has Filed a Verified Statement of Small Entity Status in Compliance with 37 CFR 1.27

08/709487

PATENT APPLICATION

08709487

APPROVED FOR LICENSE OCT 0 9 9 62 [6]
INITIALS

CONTENTS

Date Entered or Counted			Date Received or Mailed
	1.	Application 3 papers.	
	2.	PRIOR ART	3-24-97
	3.	Pre Amdt A	5-27-97
DWK	4.	Rej — 3 Mos	12-10-97
	5.	Amdt B	3/11/98 CM
5-26	6.	FINAL REJ — 3 Mos	6-2-98
	7.	Req. for CPA	9-2-98
	8.	Recon.	9-2-98
	9.	REJ (3 month)	10/7/98
	10.	Change of Address/Customer #	12-8-98
	11.	Ext of Time 1 mo.	2-8-99
	12.	Req for Recon	2-8-99
4-12	13.	Rej (3 mos)	4-14-99
	14.	Amdt C	7-19-99
9b	15.	F. Rej. 3 mos	9/24/99
	16.	Notice of Appeal	12-30-99
	17.	Amdt D w/ Attach (AE)	12-30-99
	18.	Interview Summary	1-20-00
1-21	19.	Notice Allow	1-21-00
3-28-00	20.	Formal Drawings (3 shts) set 1	2-28-00
	21.		
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SEARCHED

Class	Sub.	Date	Exmr.
382 ↓ 382	167 276 266 239 162	12-1-97 ↓ 12-2-97	dG ↓ dG
update all of the above	Searched	5-11-98	dG
update all of the above	searched	9-29-98	dG
358 ↓	518 527	9-30-98 ↓	dG ↓
update all of 358 345 ↓	Searched the above 520 418 431	4-10-99 ↓	dG ↓
update searched all of the above		9-17-99	dG
update Searched all of the above		1-20-00	dG

SEARCH NOTES

	Date	Exmr.
STN	5-6-98	dG
IEEE	9-29-98	dG
APS	4-10-99	dG

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
382 ↓ 358 ↓	162 167 239 266 276 518 520 527	1-20-00 INTERFERENCE FILES are Unavailable ↓	dG

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POSITION		ID NO.	DATE
CLASSIFIER	#44		10-1-96
EXAMINER		708	101796
TYPIST		amo	10/19
VERIFIER		277	10-25
CORPS CORR.			
SPEC. HAND			
FILE MAINT.			
DRAFTING			

INDEX OF CLAIMS

Claim		Date							
Final	Original	12/2/97	5/11/98	9/30/98	4/11/99	9/20/99	1/20/00		
1	1	✓	✓	✓	✓	✓	=		
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3	3	✓	✓						
4	4	✓	✓						
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7	7	✓	✓						
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SYMBOLS

✓ .... Rejected
= .... Allowed
- (Through numberal) Canceled
÷ .... Restricted
N .... Non-elected
I .... Interference
A .... Appeal
O .... Objected

Claim		Date							
Final	Original								
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PATENT NUMBER

APPLICATION SERIAL NUMBER

08/709,487

APPLICANT'S NAME (PLEASE PRINT)

HULTGREN, et al.

IF REISSUE, ORIGINAL PATENT NUMBER

INTERNATIONAL CLASSIFICATION

G	0	6	K		9/00
G	0	6	K		9/36
G	0	3	F		3/08
G	0	3	F		3/10

ORIGINAL CLASSIFICATION

CLASS	SUBCLASS
382	276

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)			
382	162	167	266	
345	431			
358	518	527		

GROUP ART UNIT: 2721

ASSISTANT EXAMINER (PLEASE STAMP OR PRINT FULL NAME): DANIEL G. MARIAM

PRIMARY EXAMINER (PLEASE STAMP OR PRINT FULL NAME): ANDREW W. JOHNS

Andrew W. Johns

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

PTO 270
(REV. 5-91)

ISSUE CLASSIFICATION SLIP

US006128415A

United States Patent [19]

Hultgren, III et al.

[11] Patent Number: 6,128,415

[45] Date of Patent: *Oct. 3, 2000

[54] **DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM**

[75] Inventors: **Bror O. Hultgren, III**, Ipswich; **F. Richard Cottrell**, Easton; **Jay E. Thornton**, Watertown, all of Mass.

[73] Assignee: **Polaroid Corporation**, Cambridge, Mass.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/709,487**

[22] Filed: **Sep. 6, 1996**

[51] **Int. Cl.**[7] **G06K 9/00**; G06K 9/36; G03F 3/08; G03F 3/10

[52] **U.S. Cl.** **382/276**; 382/162; 382/167; 382/266; 345/431; 358/518; 358/527

[58] **Field of Search** 382/167, 276, 382/266, 239, 162; 358/518, 527, 520; 345/418, 431

[56] **References Cited**

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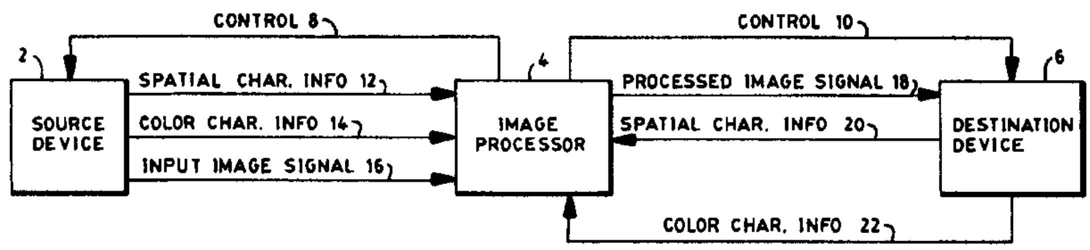
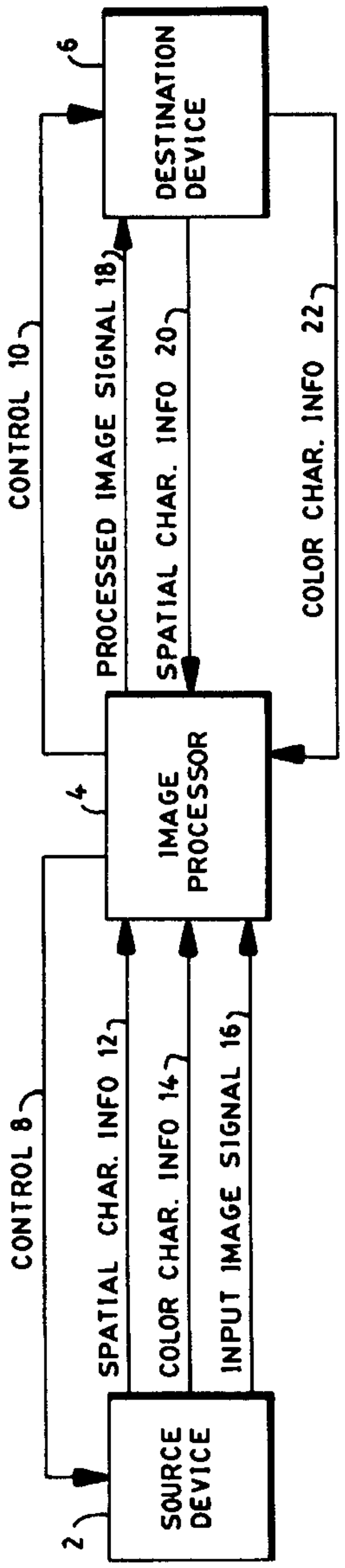
Primary Examiner—Andrew J. Johns
Assistant Examiner—Daniel G. Mariam
Attorney, Agent, or Firm—Robert J. Decker

[57] **ABSTRACT**

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

33 Claims, 3 Drawing Sheets





DESTINATION DEVICE
6
CONTROL 10
PROCESSED IMAGE SIGNAL 18
SPATIAL CHAR. INFO 20
COLOR CHAR. INFO 22
IMAGE PROCESSOR
4
CONTROL 8
SPATIAL CHAR. INFO 12
COLOR CHAR. INFO 14
INPUT IMAGE SIGNAL 16
SOURCE DEVICE
2

FIG. 1

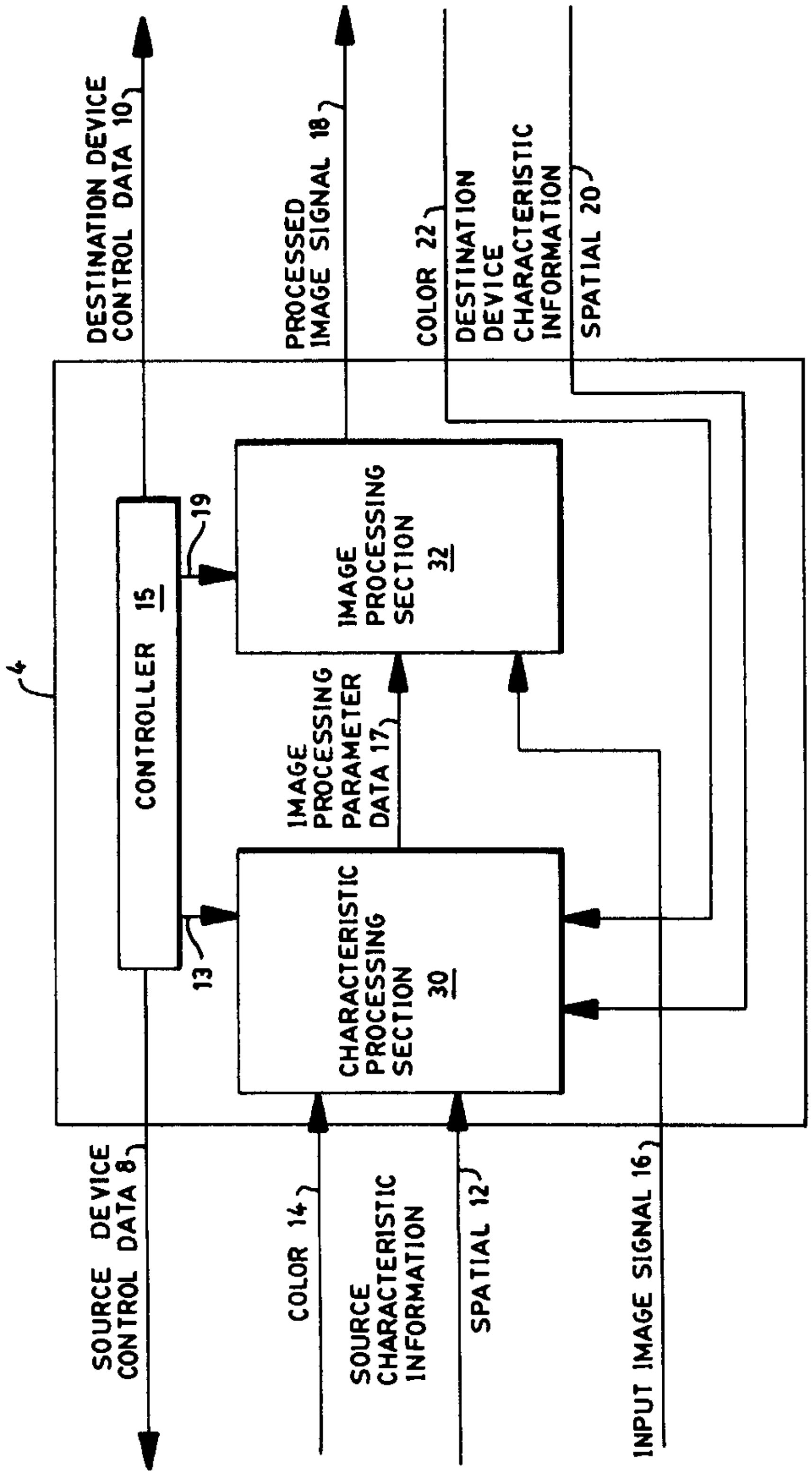

DESTINATION DEVICE CONTROL DATA 10
PROCESSED IMAGE SIGNAL 18
COLOR 22
DESTINATION DEVICE CHARACTERISTIC INFORMATION
SPATIAL 20
4
CONTROLLER 15
19
13
IMAGE PROCESSING SECTION 32
IMAGE PROCESSING PARAMETER DATA 17
CHARACTERISTIC PROCESSING SECTION 30
SOURCE DEVICE CONTROL DATA 8
COLOR 14
SOURCE CHARACTERISTIC INFORMATION
SPATIAL 12
INPUT IMAGE SIGNAL 16

FIG. 2

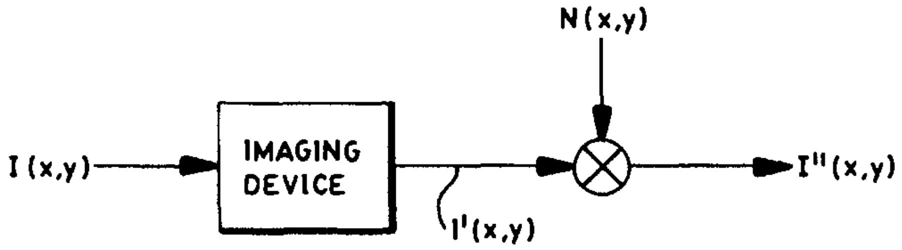

N(x,y)
I(x,y)
IMAGING DEVICE
I'(x,y)
I''(x,y)

FIG. 3

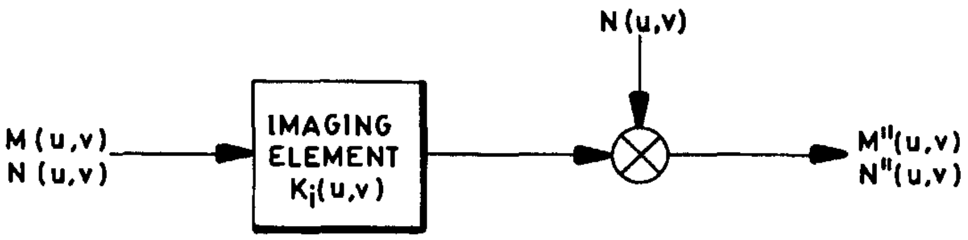

N(u,v)
M(u,v)
N(u,v)
IMAGING ELEMENT
Ki(u,v)
M''(u,v)
N''(u,v)

FIG. 4

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed generally towards digital image processing and more specifically towards generation and use of an improved device profile for describing both spatial and color properties of a device within an image processing system, so that a processed image can be more accurately captured, transformed or rendered.

2. Description of the Prior Art

Digital image processing involves electronically capturing an image of a scene, altering the captured image in some desired fashion and passing the altered image to an output device. An upstream element of a digital image processing system can be thought of as a source device, whereas a downstream element can be thought of as a destination device. For instance, a simple image processing system could include an acquisition device such as a digital camera, camcorder, scanner, CCD, etc., a color processor for processing the colors of the image, and an output device, such as a printer, monitor, computer memory, etc. When considering a communication between the acquisition device and the color processor, the acquisition device is deemed as the source device whereas the color processor is deemed as the destination device. When considering a communication between the color processor and the output device, the color processor is deemed as the source device whereas the output device is deemed as the destination device.

All imaging devices, either image acquisition or image display, will impose distortions of the color and spatial components of the image data.

Historically, industry has chosen to correct these distortions with device dependent solutions. It is common practice in the industry that an integral part of the design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices to ameliorate these distortions. For example, electronic peaking filters are often employed in video capture devices to correct for the blurring effects of anti-aliasing filters and amplifier frequency response. Electronic imaging devices are commonly designed to function with specific upstream (in the case of display devices) or downstream (in the case of image sources) devices to provide quality images. For example, image capture devices commonly transform the image digits to compensate ('gamma corrected') for the CRT volts-luminance characteristics of CRT displays. Such design considerations provide a device dependent model for that specific implementation of an image processing system, but do not provide the same degree of image quality when substituting an alternative device.

Recently, device independent paradigms for the characterization of color information in an image processing system have been developed and are being implemented: Color Sync, developed by Apple Computer and KCMS, developed by Eastman Kodak Co., are examples of systems or components supporting a device independent color paradigm. This paradigm is based upon a characterization of the image pixel data (digits) in a device independent color space—e.g. CIE L*a*b* or CIE XYZ, and the use of a Color Management System. The characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device. However, the spatial characteristics of digital imaging devices are still modified in the context of the device dependent model described above.

In order to improve processing flexibility and versatility, it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system. This paradigm will capture the spatial characterization of the imaging device in a tagged file format, referred to as a device spatial profile.

SUMMARY OF THE INVENTION

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured chromatic response and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned aspects and other features of the invention are described in detail in conjunction with the accompanying drawings in which the same reference numerals are used throughout for denoting corresponding elements and wherein:

FIG. 1 is a block diagram of a basic digital image processing system according to the invention;

FIG. 2 is a detailed block diagram of the image processor of FIG. 1;

FIG. 3 is a model of characteristic functions sufficient to reconstruct signal and noise power distributions for linear, stationary image systems having additive noise; and

FIG. 4 is a model of the effect of an image processing element upon an image.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A simplified version of a digital image processing system is shown in the block diagram of FIG. 1. The acquisition device 2, for instance a digital camera, acquires an image which is represented as the input image signal 16. The image processor 4 receives the input image signal 16, acquisition device spatial characteristic information 12 and acquisition device color characteristic information 14 in response to a control signal 8. The image processor 4 also receives output device spatial characteristic information 20 and output device color characteristic information 22 from the output device 6 in response to a control signal 10. After processing the input image signal 16 in accordance with all the signals received by the processor 4, the image processor 4 sends the processed image signal 18 to output device 6, for instance a printer which produces a hardcopy of the processed image.

An image includes both spatial and chromatic information. The spatial content of an image can be described by its signal and noise power distributions. An image's signal or noise power distribution will be transformed by a device but

does not give an unique description of the device because the distributions are image specific and they will be determined by the result of all preceding image transformations. However for one class of imaging devices namely linear, stationary imaging systems with additive noise, characteristic functions sufficient to reconstruct the signal and noise power distributions can be constructed. In practice many systems not conforming to these conditions can be approximated as linear, stationary imaging systems with additive noise having sufficient accuracy to enable the prediction of perceived image quality if not full image reconstruction.

Spatial characteristics of the elements of an image processing system or platform can be represented in at least two forms. In a first form, a characteristic processing section **30** of the image processing platform contains spatial characteristic functions describing added noise and image signal transform characteristics of the source and destination devices. In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, the characteristic processing section **30** contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. patent application Ser. No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation. This patent application is hereby incorporated in its entirety to provide supplemental background information which is non-essential but helpful in appreciating the applications of the present invention.

FIG. **2** is a detailed diagram of the image processor **4** of FIG. **1**. The image processor **4** includes a controller **15**, a characteristic processing section **30** and an image processing section **32**. The characteristic processing section **30** produces image processing data **17** in response to color source characteristic information **14**, spatial source characteristic information **12**, color destination device characteristic information **22**, spatial destination device characteristic information **20**, and a first control signal **13** from the controller **15**. In turn, the image processing section **32** produces a processed image signal **18** in response to the image processing parameter data **17**, an input image signal **16** and a second control signal **19** from the controller **4**. The controller **15** also generates both source device control data **8** and destination device control data **10**.

If I(x,y) represents the intensity distribution over the spatial coordinates (x,y) of the image and I(u,v) represents the corresponding frequency domain representation of the image constructed from the Fourier transform of I(x,y), then the transformation of the image by a linear, stationary imaging element can be represented as shown in FIG. **3**. In the spatial domain the transformation is described by a Linear function S(g(x,y)):

$$I'(x,y)=S(I(x,y)) \quad (1)$$

$$I''(x,y)=S(I(x,y)+N(x,y)) \quad (2)$$

and in the Fourier (spatial frequency) domain by the Fourier Transform S(G(u,u)) of S(g(x,y)):

$$I(u,v)=S(I(u,v)) \quad (3)$$

$$I''(u,v)=S(I(u,v)+N(u,v)) \quad (4)$$

where N(x,y) and its corresponding Fourier Transform N(u,v) represents the additive noise.

For a linear, stationary imaging system, the transfer function S(g(x,y)) is given by

$$S(g(x,y))=s(x,y)\otimes g(x,y) \quad (5)$$

where $\otimes$ signifies convolution. S(G(u,v) is given by:

$$S(G(u,v))=S(u,v)*G(u,v) \quad (6)$$

where * signifies point multiplication.

In principle S(u,v) can be computed from the ratio of the output/input signal power distributions. In practice, S(u,v) is determined from fourier analysis of images of step input images via edge gradient analysis, or point or line images via point or line spread analysis. The transfer function is commonly called the Modulation Transfer Function (MTF).

If the input image is an uniform image $I(x,y)=I_0$, Fourier analysis of the output image will yield the Wiener Noise Power Spectrum N(u,v) which is the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

As stated previously, most real systems violate the criteria for being linear and stationary; and while introducing additive noise, that noise is often gray level dependent. This type of noise is referred to as non-linear, non-stationary, gray level dependent additive noise.

If a number of uniform field images, each described by a constant intensity I_y (where Y represents the luminance level) are processed by a device, Fourier analysis of the output images will yield Wiener Noise Power Spectra $N_y(u, v)$. The set of gray level dependent Wiener Noise Power Spectra represents the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

For non-linear image transforms a set of signal level dependent MTFs could, in principle, be generated to represent the characteristic functions describing the signal transform in the imaging device. In practice a single characteristic function can be generated from an ensemble average of MTFs or a small signal approximation. In general all of these characteristic functions are two-dimensional functions which are represented as M(u,v).

For non-stationary image transforms the image signal transform characteristic function can, in principle, be represented by a multi-dimensional function, M(x,y,u,v), generated from a local fourier analysis of the point spread function located at the position (x,y). In practice the characteristic function can be approximated by an ensemble average of the position dependent multi-dimensional function M(x,y,u,v).

$$M(u,v)=\langle M(x,y,u,v)\rangle_{xy} \quad (7)$$

where the operation $\langle M(x,y,u,v)\rangle_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y.

The processing of spatial characteristic functions in the image processing system of the preferred embodiment is model based. For a linear imaging system with additive noise, each image processing element is represented by a transfer function that is a model of the effect of that image processing element upon an image as shown in FIG. **4** and defined by equations (7) and (8) in the frequency domain.

$$M''(u,v)=Ki(u,v)*M(u,v) \quad (8)$$

$$N''(u,v)=Ki^2(u,v)*N(u,v)+Ni(u,v) \quad (9)$$

For non-linear imaging elements, the transfer function may be a more general representation of the characteristic func-

tions presented to the imaging element and evaluated in terms of a model of the imaging element.

Spatial characteristic functions are generated from fourier analysis of selected target images. Characteristic functions (a) may be scalar, one or two dimensional arrays for at least one of the device N channels, (b) are evaluated over the spatial frequency range 0 to the Nyquist frequency in equal frequency intervals, and (c) for source devices may be stated either in a proprietary processing space or in device independent space.

In the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format, as described in the ICC Profile Specification, version 3. 10b dated Oct. 21, 1995. The tagged format should include information as to which class the particular characteristic function belongs, i.e. Modulation Transfer Functions, Wiener Noise Power Spectra, or gray level dependent Wiener noise masks. The tagged format should also include information sufficient to identify both the relevant units of spatial frequency and the dimensionality of the characteristic functions. Propagation of characteristic functions is calculated within the context of the model based image processing system.

It is to be understood that the above described embodiments are merely illustrative of the present invention and represent a limited number of the possible specific embodiments that can provide applications of the principles of the invention. Numerous and varied other arrangements may be readily devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention as claimed.

What is claimed is:

1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.

2. The device profile of claim 1 wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

3. The device profile of claim 2, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

4. The device profile of claim 1, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

5. The device profile of claim 1, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

6. The device profile of claim 5, wherein said gray level dependent additive noise is spatially dependent.

7. The device profile of claim 1, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

8. The device profile of claim 7, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

9. The device profile of claim 1 wherein, for said device, the second data is generated through use of spatial stimuli and device response characteristic functions.

10. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;

generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and

combining said first and second data into the device profile.

11. The method of claim 10 wherein, for said device:

said second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

12. The method of claim 11 wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

13. The method of claim 11 wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

14. The method of claim 11, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

15. The method of claim 13, wherein said gray level dependent additive noise is spatially dependent.

16. The method of claim 11, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

17. The method of claim 16, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

18. A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space through use of chromatic response characteristic functions; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device independent color space through the use of spatial characteristic fmctions describing image spatial transform characteristics in said device independent color space.

19. The system of claim 18, wherein the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

20. The system of claim 19, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

21. The system of claim 18, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

22. The system of claim 18, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

23. The system of claim **22**, wherein said gray level dependent additive noise is spatially dependent.

24. The system of claim **18**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

25. The system of claim **24**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

26. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

27. The device profile of claim **26** wherein, for said device, the data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

28. The device profile of claim **27**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

29. The device profile of claim **26**, wherein the data is represented by characteristic functions describing a gray level dependent additive noise in said device.

30. The device profile of claim **26**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

31. The device profile of claim **30**, wherein said gray level dependent additive noise is spatially dependent.

32. The device profile of claim **26**, wherein the data is represented by characteristic functions describing spatially dependent additive noise in said device.

33. The device profile of claim **32**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

* * * * *

PATENT APPLICATION SERIAL NO. 08/709487

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PATENT AND TRADEMARK OFFICE
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION

OF

BROR O. HULTGREN III
F. RICHARD COTTRELL
AND
JAY E. THORNTON

FOR

DEVICE PROFILES FOR USE IN

A DIGITAL IMAGE PROCESSING SYSTEM

08/709487

8166 PATENT

ABSTRACT OF THE DISCLOSURE

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

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8166 PATENT

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed generally towards digital image processing and more specifically towards generation and use of an improved device profile for describing both spatial and color properties of a device within an image processing system, so that a processed image can be more accurately captured, transformed or rendered.

2. Description of the Prior Art

Digital image processing involves electronically capturing an image of a scene, altering the captured image in some desired fashion and passing the altered image to an output device. An upstream element of a digital image processing system can be thought of as a source device, whereas a downstream element can be thought of as a destination device. For instance, a simple image processing system could include an acquisition device such as a digital camera, camcorder, scanner, CCD, etc., a color processor for processing the colors of the image, and an output device, such as a printer, monitor, computer memory, etc. When considering a communication between the acquisition device and the color processor, the acquisition device is deemed as the source device whereas the color processor is deemed as the destination device. When considering a communication between the color processor and the output device, the color processor is deemed as the source device whereas the output device is deemed as the destination device.

All imaging devices, either image acquisition or image display, will impose distortions of the color and spatial components of the image data.

Historically, industry has chosen to correct these distortions with device dependent solutions. It is common practice in the industry that an integral part of the

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design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices to ameliorate these distortions. For example, electronic peaking filters are often employed in video capture devices to correct for the blurring effects of anti-aliasing filters and amplifier frequency response. Electronic imaging devices are commonly designed to function with specific upstream (in the case of display devices) or downstream (in the case of image sources) devices to provide quality images. For example, image capture devices commonly transform the image digits to compensate ('gamma corrected') for the CRT volts-luminance characteristics of CRT displays. Such design considerations provide a device dependent model for that specific implementation of an image processing system, but do not provide the same degree of image quality when substituting an alternative device.

Recently, device independent paradigms for the characterization of color information in an image processing system have been developed and are being implemented: Color Sync, developed by Apple Computer and KCMS, developed by Eastman Kodak Co., are examples of systems or components supporting a device independent color paradigm. This paradigm is based upon a characterization of the image pixel data (digits) in a device independent color space -- e.g. CIE L*a*b* or CIE XYZ, and the use of a Color Management System. The characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device. However, the spatial characteristics of digital imaging devices are still modified in the context of the device dependent model described above.

In order to improve processing flexibility and versatility, it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system. This paradigm will

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capture the spatial characterization of the imaging device in a tagged file format, referred to as a device spatial profile.

SUMMARY OF THE INVENTION

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured response chromatic and spatial stimuli and device response ~~characteristic functions~~ within a model based image processing system to predict both color and spatial characteristic functions of ~~characteristics of a processed image~~ an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned aspects and other features of the invention are described in detail in conjunction with the accompanying drawings in which the same reference numerals are used throughout for denoting corresponding elements and wherein:

Figure 1 is a block diagram of a basic digital image processing system according to the invention;

Figure 2 is a detailed block diagram of the image processor of Figure 1;

Figure 3 is a model of characteristic functions sufficient to reconstruct signal and noise power distributions for linear, stationary image systems having additive noise; and

Figure 4 is a model of the effect of an image processing element upon an image.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A simplified version of a digital image processing system is shown in the block diagram of Figure 1. The acquisition device 2, for instance a digital camera, acquires an image which is represented as the input image signal 16. The image processor 4 receives the input image signal 16, acquisition device spatial characteristic information 12 and acquisition device color characteristic information 14 in response to a control signal 8. The image processor 4 also receives output device spatial characteristic information 20 and output device color characteristic information 22 from the output device 6 in response to a control signal 10. After processing the input image signal 16 in accordance with all the signals received by the processor 4, the image processor 4 sends the processed image signal 18 to output device 6, for instance a printer which produces a hardcopy of the processed image.

An image includes both spatial and chromatic information. The spatial content of an image can be described by its signal and noise power distributions. An image's signal or noise power distribution will be transformed by a device but does not give an unique description of the device because the distributions are image specific and they will be determined by the result of all preceding image transformations. However for one class of imaging devices namely linear, stationary imaging systems with additive noise, characteristic functions sufficient to reconstruct the signal and noise power distributions can be constructed. In practice many systems not conforming to these conditions can be approximated as linear, stationary imaging systems with additive noise having sufficient accuracy to enable the prediction of perceived image quality if not full image reconstruction.

Spatial characteristics of the elements of an image processing system or platform can be represented in at least two forms. In a first form, a characteristic processing section 30 of the image processing platform contains spatial characteristic functions describing added noise and image signal transform characteristics of the

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source and destination devices. In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, a the characteristic processing section 30 contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. Patent Application No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation. This patent application is hereby incorporated in its entirety to provide supplemental background information which is non-essential but helpful in appreciating the applications of the present invention.

Insert a'

If I(x,y) represents the intensity distribution over the spatial coordinates (x,y) of the image and $\mathcal{I}(u,v)$ represents the corresponding frequency domain representation of the image constructed from the Fourier transform of I(x,y), then the transformation of the image by a linear, stationary imaging element can be represented as shown in Figure 3. In the spatial domain the transformation is described by a Linear function S(g(x,y)):

$$I'(x,y) = S(I(x,y)) \quad (1)$$

$$I''(x,y) = S(I(x,y) + N(x,y)) \quad (2)$$

and in the Fourier (spatial frequency) domain by the Fourier Transform $\mathcal{S}(\mathcal{G}(u,v))$ of S(g(x,y)):

$$\mathcal{I}'(u,v) = \mathcal{S}(\mathcal{I}(u,v)) \quad (3)$$

$$\mathcal{I}''(u,v) = \mathcal{S}(\mathcal{I}(u,v) + \mathcal{N}(u,v)) \quad (4)$$

where N(x,y) and its corresponding Fourier Transform $\mathcal{N}(u,v)$ represents the additive noise.

For a linear, stationary imaging system, the transfer function **S(g(x,y))** is given by

$$\mathbf{S(g(x,y))} = \mathbf{s(x,y)} \otimes \mathbf{g(x,y)} \qquad \mathbf{(5)}$$

where $\otimes$ signifies convolution. $\mathcal{S}(\mathcal{G}(u,v))$ is given by:

$$\mathcal{S}(\mathcal{G}(u,v)) = \mathcal{S}(u,v) * \mathcal{G}(u,v) \qquad \mathbf{(6)}$$

where * signifies point multiplication.

In principle $\mathcal{S}(u,v)$ can be computed from the ratio of the output/input signal power distributions. In practice, $\mathcal{S}(u,v)$ is determined from fourier analysis of images of step input images via edge gradient analysis, or point or line images via point or line spread analysis. The transfer function is commonly called the Modulation Transfer Function (MTF).

If the input image is an uniform image $I(x,y) = I_0$, Fourier analysis of the output image will yield the Wiener Noise Power Spectrum $\mathcal{N}(u,v)$ which is the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

As stated previously, most real systems violate the criteria for being linear and stationary; and while introducing additive noise, that noise is often gray level dependent. This type of noise is referred to as non-linear, non-stationary, gray level dependent additive noise.

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If a number of uniform field images, each described by a constant intensity I_Y (where Y represents the luminance level) are processed by a device, Fourier analysis of the output images will yield Wiener Noise Power Spectra $\eta_Y(u,v)$. The set of gray level dependent Wiener Noise Power Spectra represents the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

For non-linear image transforms a set of signal level dependent MTFs could, in principle, be generated to represent the characteristic functions describing the signal transform in the imaging device. In practice a single characteristic function can be generated from an ensemble average of MTFs or a small signal approximation. In general all of these characteristic functions are two-dimensional functions which are represented as M(u,v).

For non-stationary image transforms the image signal transform characteristic function can, in principle, be represented by a multi-dimensional function, M(x,y,u,v), generated from a local fourier analysis of the point spread function located at the position (x,y). In practice the characteristic function can be approximated by an ensemble average of the position dependent multi-dimensional function M(x,y,u,v).

$$M(u,v) = \langle M(x,y,u,v) \rangle_{xy} \qquad (7)$$

where the operation $\langle M(x,y,u,v) \rangle_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y.

The processing of spatial characteristic functions in the image processing system of the preferred embodiment is model based. For a linear imaging system with additive noise, each image processing element is represented by a transfer function that is a model of the effect of that image processing element upon an

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image as shown in Figure 4 and defined by equations (7) and (8) in the frequency domain.

$$M''(u,v) = K'(u,v) * M(u,v) \qquad (8)$$

$$N''(u,v) = K_i^2(u,v) * N(u,v) + N'(u,v) \qquad (9)$$

For non-linear imaging elements, the transfer function may be a more general representation of the characteristic functions presented to the imaging element and evaluated in terms of a model of the imaging element.

Spatial characteristic functions are generated from fourier analysis of selected target images. Characteristic functions (a) may be scalar, one or two dimensional arrays for at least one of the device N channels, (b) are evaluated over the spatial frequency range 0 to the Nyquist frequency in equal frequency intervals, and (c) for source devices may be stated either in a proprietary processing space or in device independent space.

In the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format, as described in the ICC Profile Specification, version 3.10b dated October 21, 1995. The tagged format should include information as to which class the particular characteristic function belongs, i.e. Modulation Transfer Functions, Wiener Noise Power Spectra, or gray level dependent Wiener noise masks. The tagged format should also include information sufficient to identify both the relevant units of spatial frequency and the dimensionality of the characteristic functions. Propagation of characteristic functions is calculated within the context of the model based image processing system.

It is to be understood that the above described embodiments are merely illustrative of the present invention and represent a limited number of the possible

specific embodiments that can provide applications of the principles of the invention. Numerous and varied other arrangements may be readily devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention as claimed.

CLAIMS:

Sub B1

1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image; and

second data for describing a device dependent transformation of spatial information content of the image.

2. The device profile of claim 1 wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

3. The device profile of claim 2, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

4. The device profile of claim 1, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

5. The device profile of claim 1, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

6. The device profile of claim 5, wherein said gray level dependent additive noise is spatially dependent.

7. The device profile of claim 1, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

8. The device profile of claim 7, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

SUB B3

9. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image in response to a color characteristic function describing added noise characteristics;

generating second data for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image signal transform characteristics; and

combining said first and second data into the device profile.

5.6 C4)

10. The method of claim 9 wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

11. The method of claim 9 wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

12 The method of claim 9, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

15 ~~13~~. The method of claim ~~11~~ 13, wherein said gray level dependent additive noise is spatially dependent.

5.5 C5)

14. The method of claim 9, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

~~15~~. 17 The method of claim ~~14~~ 16, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

SUB B3

16. A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

~~means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image in response to a color characteristic function describing added noise characteristics; and~~

~~means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image signal transform characteristics.~~

19 ~~17~~. The system of claim ~~16~~ 18, wherein the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

20 ~~18~~. The system of claim ~~17~~ 19, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

21 ~~19~~. The system of claim ~~16~~ 18, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

22 ~~20~~. The system of claim ~~16~~ 18, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

23 ~~21~~. The system of claim ~~20~~ 22, wherein said gray level dependent additive noise is spatially dependent.

24 ~~22~~. The system of claim ~~16~~ 18, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

25 ~~23~~. The system of claim ~~22~~ 24, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

~~24. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image.~~

27 ~~25~~. The device profile of claim ~~24~~ 26 wherein, for said device, the data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

28 ~~26~~. The device profile of claim ~~25~~, 27 wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

29 ~~27~~. The device profile of claim ~~24~~, 26 wherein the data is represented by characteristic functions describing a gray level dependent additive noise in said device.

30 ~~28~~. The device profile of claim ~~24~~, 26 wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

31 ~~29~~. The device profile of claim ~~28~~, 30 wherein said gray level dependent additive noise is spatially dependent.

32 ~~30~~. The device profile of claim ~~24~~, 26 wherein the data is represented by characteristic functions describing spatially dependent additive noise in said device.

33 ~~31~~. The device profile of claim ~~30~~, 32 wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

A1d(r)

8166

PATENT

08/709,489

DECLARATION AND POWER OF ATTORNEY

As below named inventors, we hereby declare that:

Our residence, post office address and citizenship are as stated below next to our names;

We believe we are the original, first and sole inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM, the specification of which is attached hereto;

We have reviewed and understand the contents of the above identified specification, including the claims;

We acknowledge the duty to disclose information material to the patentability of the claims as defined in Title 37, Code of Federal Regulations, §1.56(a);

1 We appoint Robert A. Sabourin, Reg. No. 35,344 c/o Polaroid Corporation, Patent Department, 549 Technology Square, Cambridge, Massachusetts 02139, as our attorney with full power of substitution, and revocation, to prosecute this application, to make alterations and amendments therein, to receive the Letters Patent, and to transact all business in the Patent Office connected therewith; and

All statements made herein of our own knowledge are true and all statements made on information and belief are believed to be true; and further these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00 Full name of first inventor Bror O. Hultgren III
First Inventor's Signature Bror O. Hultgren III
Date September 6, 1996
Residence 6 Jeffrey's Neck Road, Ipswich, MA 01938
Citizenship United States of America MA
Post Office Address same as above

2-00 Full name of second joint inventor F. Richard Cottrell
Second Inventor's Signature F. Richard Cottrell
Date September 6, 1996
Residence 49 Kennedy Circle, Easton, MA 02375
Citizenship United States of America MA
Post Office Address same as above

3-00 Full name of second joint inventor Jay E. Thornton
Second Inventor's Signature Jay E. Thornton
Date September 6, 1996
Residence 56 Lincoln Street, Watertown, MA 02172 MA
Citizenship United States of America
Post Office Address same as above

Assignment Document

While copying your file we noticed that the Application Transmittal letter states that an assignment document was originally filed with this case.
At your request, we will attempt to obtain the assignment documents from the assignment branch located within the USPTO. Please note that additional charges will apply to this service.

08/709487

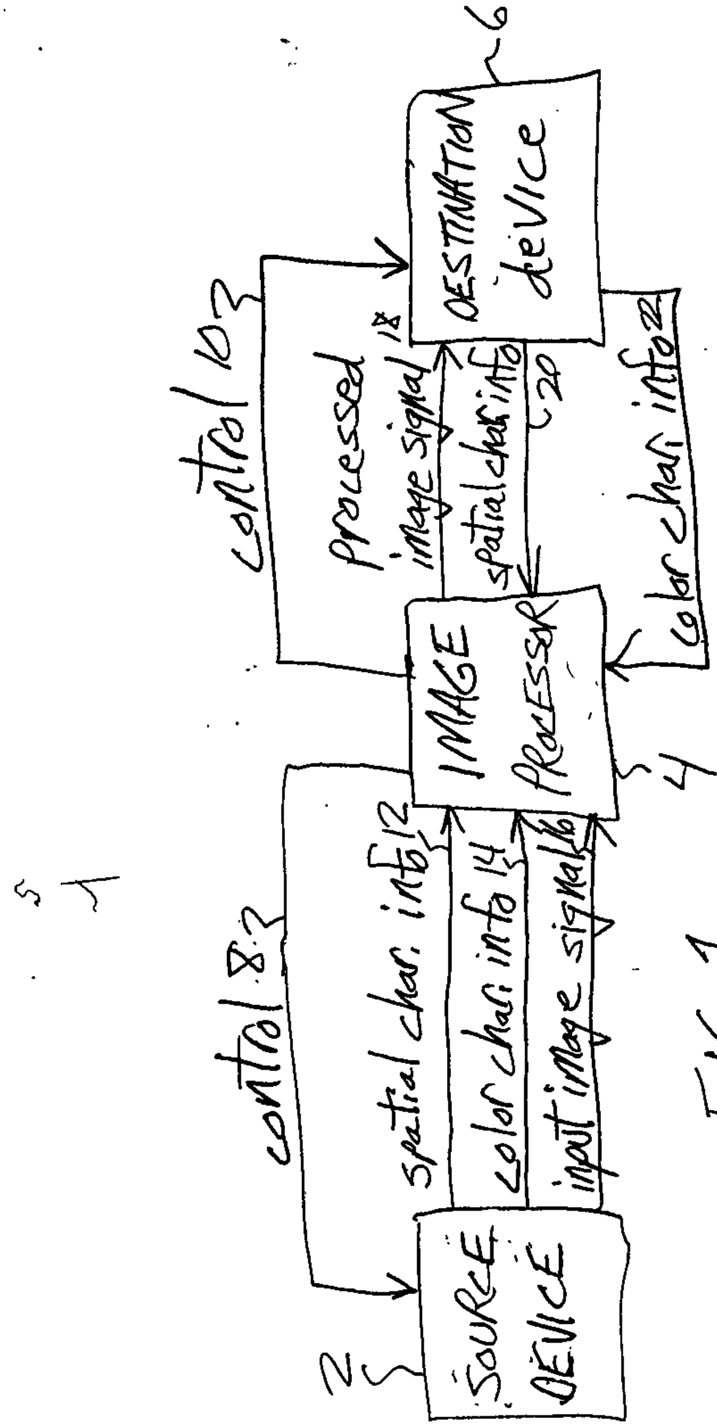

FIG. 1

PRINT OF DRAWINGS AS ORIGINALLY FILED

08/709487

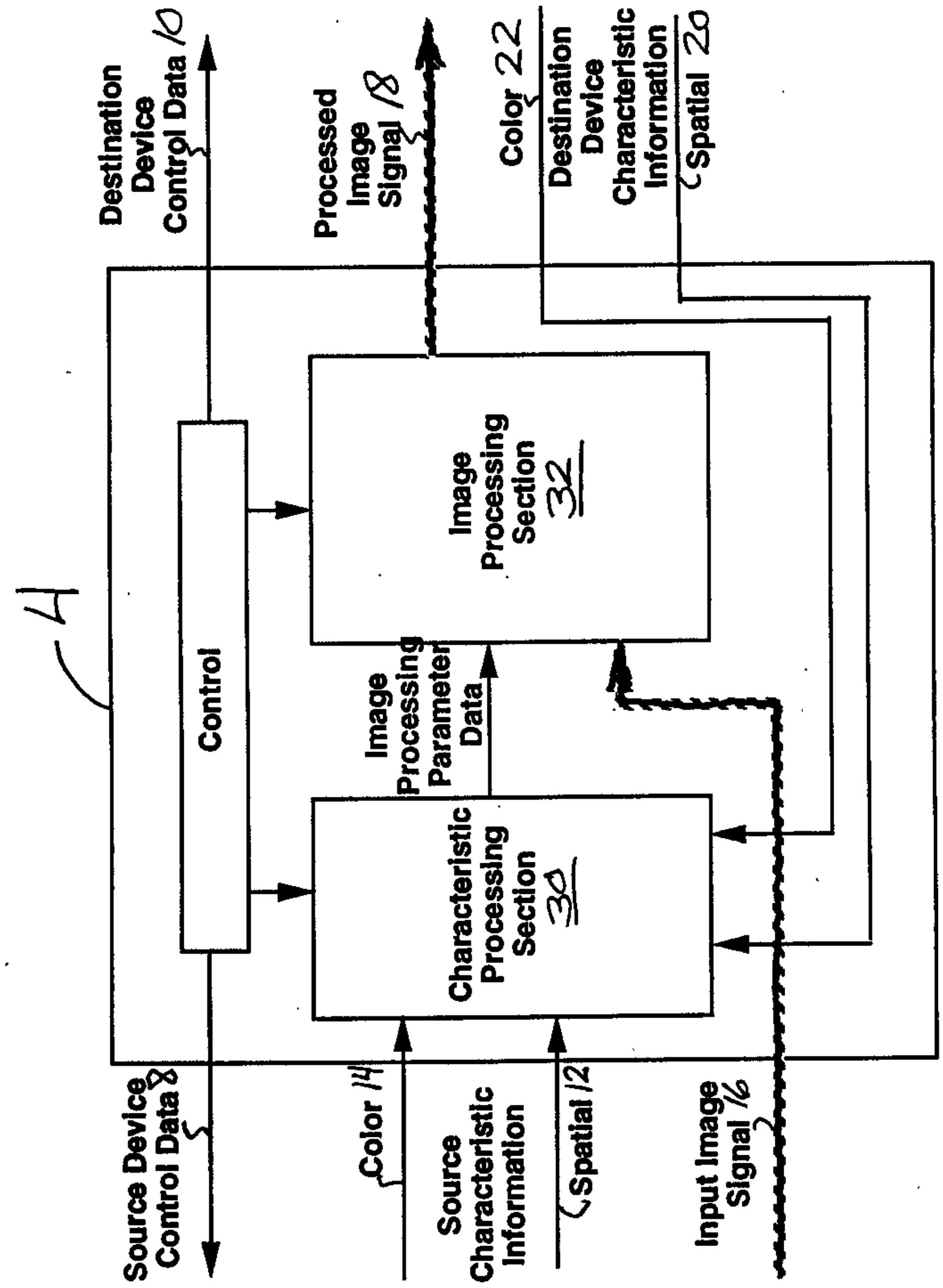

FIG 2.

08/709487

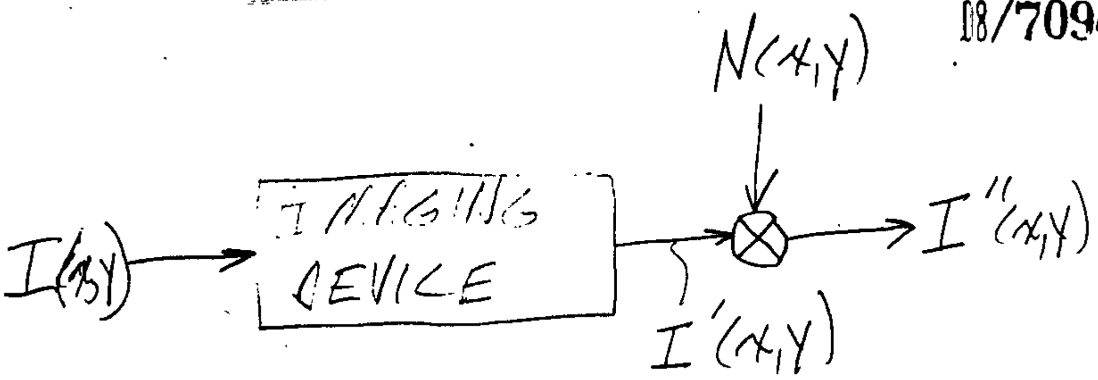

FIG. 3

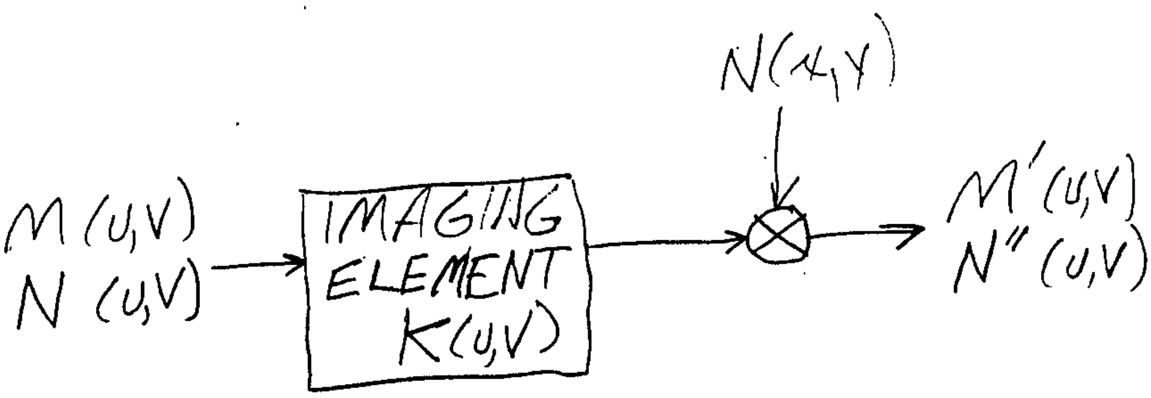

FIG. 4

08/709487

MAIL ROOM SEP 6 1996 EXP PAT. & TRADEMARK OFC.

POLAROID CORPORATION
575 TECHNOLOGY SQUARE - 3RD FLOOR
CAMBRIDGE, MASSACHUSETTS 02139 U.S.A.

ROBERT A. SABOURIN
PATENT ATTORNEY

TEL: 617-386-6413
FAX: 617-386-6436
NET: sabourr@polaroid.com

TRANSMITTAL LETTER

Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

September 6, 1996

Our File No. 8166 (RAS)

Sir:

Enclosed herewith are a 9 page specification, abstract, 4 pages of claims, 3 pages of drawings, a Declaration and Power of Attorney, Assignment, Form PTO-1595, a Certificate of Express Mailing, and a postcard in connection with an application of Bror O. Hultgren III, et al. for a patent entitled DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

There is also enclosed a check (check no. 15885) to cover the cost of filing the application and recording the assignment, as follows:

Basic Fee	$ 750.00
Additional Fees:	
Total number of claims in excess of 20, times $22	$ 242.00
Number of independent claims minus 3, times $78	$ 78.00
Multiple dependent claims, times $250	$ 0.00
Total Filing Fee	$1070.00
Assignment Recording Fee	$ 40.00
Total Enclosed	$1110.00

It is respectfully requested that the Deposit Account of Polaroid Corporation (Account No. 16-2195) be credited with any excess filing fee or charged for any deficiency in filing fee.

Please address all communications from the Patent Office in connection with this application to Polaroid Corporation, Patent Department, 549 Technology Square, Cambridge, Massachusetts 02139.

Respectfully,

Robert A. Sabourin

Robert A. Sabourin
Registration No. 35,344

08/709487

MAIL ROOM SEP 6 1996 10 EH166 PAT. & TRADEMARK OFF.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Bror O. Hultgren III et al.	Group: not yet assigned	
Serial No.:	not yet assigned	Examiner:	not yet assigned
Filed:	September 6, 1996		
For:	DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM		

EXPRESS MAILING CERTIFICATION

Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

Sir:

I hereby certify that a 9 page specification, a one page abstract, 4 pages of claims, 3 pages of drawings, a Transmittal Letter, a Declaration and Power of Attorney, Form PTO-1595, an Assignment, check no. 15885 in the amount of $1,110.00 and a postcard is being deposited on September 6, 1996 with the United States Postal Service with sufficient postage as Post Office Express Mail to Addressee No. EH303475732US in an envelope addressed to: Assistant Commissioner for Patents, Box Patent Application, Washington, D.C. 20231.

Respectfully,

Jennifer Einstein
Jennifer Einstein

2606

#2
I.D.
4-11-97
PATENT

MAIL ROOM
MAR 24 1997
PAT. & TRADEMARK OFF.

8166
62

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Bror O. Hultgren III et al.	Group:	2606
Serial No.:	08/709,487	Examiner:	not yet assigned
Filed:	September 6, 1996		
For:	DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM		

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner for Patents
Box DD
Washington, D.C. 20231

March 19, 1997

Sir:

In accordance with 37 C.F.R. §§1.63, 1.97 and 1.98, Applicant lists, provides copies, and provides concise explanations of the following reference.

ICC Profile Format Specification, Version 3.10b, October 21, 1995 describes standards for conventional device profiles to be adopted in an international standard by the International Color Consortium.

No fee is due since this Information Disclosure Statement is being filed before receipt of a first Office Action on the merits.

Respectfully submitted,

Robert A. Sabourin

Robert A. Sabourin
Attorney Reg. No. 35,344

Polaroid Corporation
Patent Department
575 Technology Square - 3rd Floor
Cambridge, MA. 02139

Tel: (617) 386-6413
RAS/jme

MAILING CERTIFICATION

I hereby certify that this correspondence is being deposited on March 19, 1997 with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Box DD, Washington, D.C. 20231.

Jennifer Einstein

Jennifer Einstein

C-8166 Page 1 of 1

OMB No. 0651-0011

Form PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE INFORMATION DISCLOSURE CITATION (Use Several Sheets If Necessary)	ATTY. DOCKET NO. C8166 (RAS)	SERIAL NO. 08/709,487
	APPLICANT Bror O. Hultgren III et al.	
	FILING DATE September 6, 1996	GROUP ~~2696~~ 2721

MAIL ROOM MAR 24 1997 PAT. & TRADEMARK OFFICE

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB-CLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

DG		ICC Profile Format Specification, Version 3.10b, October 21, 1995

EXAMINER	DATE CONSIDERED
Daniel G. Marian	12-1-97

***EXAMINER:** Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form PTO-FB-A820 (also form PTO-1449)

Patent and Trademark Office - U.S. DEPARTMENT OF COMMERCE

8166

PATENT #13/A

T. Hall 6-17-97

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl'n. of:	Hultgren et al.	Group:	2606
Serial No.:	08/709,487	Examiner:	not yet assigned
Filed:	September 9, 1996		
For:	DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM		

RECEIVED JUN 12 97 GROUP 2600

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Box Non-Fee Amendment
Washington, D.C. 20231

May 21, 1997

Sir:

Entry of the following amendments prior to examination and consideration is requested.

IN THE SPECIFICATION

Please amend the specification as follows.

Page 4, line 26, after "section" insert --30--;

page 5, line 4, after "section" insert --30--;

between lines 10 and 11, insert

Figure 2 is a detailed diagram of the image processor 4 of Figure 1. The image processor 4 includes a controller 15, a characteristic processing section 30 and an image processing section 32. The characteristic processing section 30 produces image processing data 17 in response to color source characteristic information 14, spatial source characteristic information 12, color destination device characteristic information 22, spatial destination device characteristic information 20, and a first control signal 13 from the controller 15. In turn, the image processing section 32 produces a processed image signal 18 in response to the image processing parameter data 17, an input image signal 16 and a second control signal 19

16

from the controller 4. The controller 15 also generates both source device control data 8 and destination device control data 10.

REMARKS

The specification has been amended to clearly recite the elements as shown in Figure 2. No new subject matter has been added to the specification.

No fees are due with this response.

In view of the foregoing Amendments, this Application is in condition for examination. Should questions arise during examination, Examiner is requested to contact Applicant's attorney at the telephone number listed below.

Respectfully submitted,

Robert A. Sabourin

Robert A. Sabourin
Attorney Reg. No. 35,344

Polaroid Corporation
Patent Department
575 Technology Square - 3rd Floor
Cambridge, MA. 02139

Tel: (617) 386-6413
RAS/pc

MAILING CERTIFICATION

I hereby certify that this correspondence is being deposited on May 21, 1997 with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Box Non-Fee Amendments, Washington, D.C. 20231.

Jennifer Einstein

Jennifer Einstein

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT		ATTY. DOCKET NO.
08/709,487	09/06/96	HULTGREN	B	8166(RAS)

LM32/1210

POLAROID CORPORATION
PATENT DEPARTMENT
549 TECHNOLOGY SQUARE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM, D	
ART UNIT	PAPER NUMBER
2721	4

DATE MAILED: 12/10/97

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

OFFICE ACTION SUMMARY

☐ Responsive to communication(s) filed on __________

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 D.C. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-31 is/are pending in the application.
Of the above, claim(s) __________ is/are withdrawn from consideration.
☐ Claim(s) __________ is/are allowed.
☒ Claim(s) 1-31 is/are rejected.
☐ Claim(s) __________ is/are objected to.
☐ Claim(s) __________ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
☐ The drawing(s) filed on __________ is/are objected to by the Examiner.
☐ The proposed drawing correction, filed on __________ is ☐ approved ☐ disapproved.
☐ The specification is objected to by the Examiner.
☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.
☐ received in Application No. (Series Code/Serial Number) __________.
☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: __________.

☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of Reference Cited, PTO-892
☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 2
☐ Interview Summary, PTO-413
☒ Notice of Draftperson's Patent Drawing Review, PTO-948
☐ Notice of Informal Patent Application, PTO-152

--SEE OFFICE ACTION ON THE FOLLOWING PAGES--

326 (Rev. 9/96)

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 9, 16, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Laumeyer et al (5,572,632) in view of Spiegel et al (5,615,282).

With regard to claim 1, Laumeyer et al discloses first data for describing a device dependent transformation of color information content of the image (column 4, lines 34-42). Laumeyer et al does not explicitly call for describing a device dependent transformation of color information content. However, Spiegel et al discloses an apparatus and techniques for processing of data such as color images comprising, ***spatial processing: detecting and/or transforming the spatial characteristics of a representation of a color image*** which may pertain to at least the characteristics of the representation of the color image and/or to the mutual relationship between adjacent portions of the color image. For example: change of format (e.g. LW to CT), change of

resolution, filtering including edge detection and processing, blur/sharp functions, etc., and combinations of these operations. . . . . .color value: a representation of a color, typically in a color coordinate system such as but not limited to RGB, L*a*b*, XYZ coordinate systems and ***device dependent*** coordinate systems such as color head signals e.g. RGB, ink percentages e.g. CMYK, etc. (Column 33, line 44 through column 34, line 8).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Spiegel et al into Laumeyer et al's system in order to transform the spatial characteristic of the color image.

Claim 9 is rejected the same as claim 1. Thus, argument analogous to that presented above for claim 1 is applicable to claim 9. As to combining the first and second data into the device profile, Laumeyer et al further discloses This two-stage process is used to transform input color specifications into device-dependent color specifications which then are stored in a frame buffer. That frame buffer stores ***device-dependent information***, such as CMYK or RGB color values, ***in describing the output image pixel data which are used to form the output signals*** controlling the printing of that printer to thereby have the print engine therein correctly set the fractions of maximum toner or ink densities that it is to provide on the selected device.

Claim 16 is rejected the same as claim 1 except claim 16 is an apparatus claim. Thus, argument analogous to that presented above for claim 1 is applicable to claim 16.

Claim 24 is rejected the same as claim 1. Thus, argument similar to that presented above for claim 1 is applicable to claim 24.

3. Claims 2-8, 10-15, 17-23 and 25-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Laumeyer et al in view of Spiegel et al as applied to claims 1, 9, 16, and 24 above, and further in view of Cottrell et al (5,694,484).

With regard to claim 2, Laumeyer et al (as modified by Spiegel et al) discloses all the claimed subject matter except explicitly calling for a first characteristic function describing added noise characteristics. However, Cottrell et al discloses system consists of a set of image-processing operations, an architecture, and an intelligent control. These elements take into consideration profiles of sources from which the images are generated, profiles of intended applications, and the impact that image processing operations (individually or in concert) will have on perceived image quality. The analysis uses a body of relationships linking human perception of image quality with objective metrics (such as sharpness, grain, tone, and color) of image content (abstract); and the characteristic processing section 21 generates the image processing parameter data to be used by the image data processing section 20 in processing the image data in relation to the specific device or methodology used to acquire the image data, and the ***specific device*** or methodology to be used. . . . . for a multi-color imaging system, ***modulation transfer functions MTF(f) are determined separately for each color. The Wiener spectrum***

characterizes the noise in the image, including that noise introduced with the original data provided by image data source 11, ***noise added*** or removed in successive processing operations in image data processing section 20, and noise introduced during rendering by the downstream utilization element. The Wiener spectrum is most easily evaluated by observing the data fluctuations in the rendered image in the case that a uniform source image is presented to the system (column 18, lines 3-52).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Cottrell et al into Laumeyer et al's (as modified by Spiegel et al) system if no other reason than to have a function describing an additive noise characteristics.

Claims 3, 7, and 8 are rejected the same as claims 1 and 2. Thus, arguments similar to those presented above for claims 1 and 2 are applicable to claims 3, 7, and 8.

With regard to claim 4, Cottrell et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Johnston et al (US 5,682,442) Image-Processing System; Doi et al (US 5,224,177) High Quality Film Image Correction and Duplication Method and System.

Effective November 16, 1997, the Examiner handling this application will be assigned to a new Art Unit as a result of the consolidation into Technology Center 2700. See the forth coming Official Gazette notice dated November 11, 1997. For any written or facsimile communication submitted ON OR AFTER November 16,1997, this Examiner, who was assigned to Art Unit **2616**, will be assigned to Art Unit **2721**. Please include the new Art Unit in the caption or heading of any communication submitted after the November 16,1997 date. Your cooperation in this matter will assist in the timely processing of the submission and is appreciated by the Office.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

December 2, 1997

LEO BOUDREAU
SUPERVISORY PATENT EXAMINER
GROUP 2600

Notice of References Cited

Application No.	Applicant(s)		
08/709,487	HULTGREN III, et al.		
Examiner	Group Art Unit	Page 1 of 1	
Daniel G. Mariam	2721		

U.S. PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
	A	5,224,177	6-29-93	Doi et al.	382	266
	B	5,572,632	11-5-96	Laumeyer et al	395	116
	C	5,682,442	10-28-97	Johnston et al	382	239
	D	5,615,282	3-25-97	Spiegel et al.	382	276
	E	5,694,484	12-02-97	Cottrell et al.	382	167
	F					
	G					
	H					
	I					
	J					
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FOREIGN PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
	N						
	O						
	P						
	Q						
	R						
	S						
	T						

NON-PATENT DOCUMENTS

*		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
	U		
	V		
	W		
	X		

* A copy of this reference is not being furnished with this Office action.
(See Manual of Patent Examining Procedure, Section 707.05(a).)

U.S. Patent and Trademark Office
PTO-892 (Rev. 9-96)

Part of Paper No. 4

*U.S. GPO: 1997-422-601/60010

Form PTO 948 (Rev. 10-94) U.S. DEPARTMENT OF COMMERCE - Patent and Trademark Office Application No. 709487

NOTICE OF DRAFTSPERSON'S PATENT DRAWING REVIEW

PTO Draftspersons review all originally filed drawings regardless of whether they are designated as formal or informal. Additionally, patent Examiners will review the drawings for compliance with the regulations. Direct telephone inquiries concerning this review to the Drawing Review Branch, 703-305-8404.

The drawings filed (insert date) 9/6/96, are
A.____ not objected to by the Draftsperson under 37 CFR 1.84 or 1.152.
B. X objected to by the Draftsperson under 37 CFR 1.84 or 1.152 as indicated below. The Examiner will require submission of new, corrected drawings when necessary. Corrected drawings must be submitted according to the instructions on the back of this Notice.

1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings: Black ink. Color.
   - ___ Not black solid lines. Fig(s)____
   - ___ Color drawings are not acceptable until petition is granted. Fig(s)____
2. PHOTOGRAPHS. 37 CFR 1.84(b)
   - ___ Photographs are not acceptable until petition is granted. Fig(s)____
   - ___ Photographs not properly mounted (must use brystol board or photographic double-weight paper). Fig(s)____
   - ___ Poor quality (half-tone). Fig(s)____
3. GRAPHIC FORMS. 37 CFR 1.84 (d)
   - ___ Chemical or mathematical formula not labeled as separate figure. Fig(s)____
   - ___ Group of waveforms not presented as a single figure, using common vertical axis with time extending along horizontal axis. Fig(s)____
   - ___ Individuals waveform not identified with a separate letter designation adjacent to the vertical axis. Fig(s)____
4. TYPE OF PAPER. 37 CFR 1.84(c)
   - Paper not flexible, strong, white, smooth, nonshiny, and durable. Sheet(s)____
   - ___ Erasures, alterations, overwritings, interlineations, cracks, creases, and folds copy machine marks not accepted. Fig(s) 1-4
   - ___ Mylar, velum paper is not acceptable (too thin). Fig(s)____
5. SIZE OF PAPER. 37 CFR 1.84(f): Acceptable sizes:
   - 21.6 cm. by 35.6 cm. (8 1/2 by 14 inches)
   - 21.6 cm. by 33.1 cm. (8 1/2 by 13 inches)
   - 21.6 cm. by 27.9 cm. (8 1/2 by 11 inches)
   - 21.0 cm. by 29.7 cm. (DIN size A4)
   - ___ All drawing sheets not the same size. Sheet(s)____
   - ___ Drawing sheet not an acceptable size. Sheet(s)____
6. MARGINS. 37 CFR 1.84(g): Acceptable margins:

Paper size

	21.6 cm. X 35.6 cm. (8 1/2 X 14 inches)	21.6 cm X 33.1 cm. (8 1/2 X 13 inches)	21.6 cm. X 27.9 cm. (8 1/2 X 11 inches)	21.0 cm. X 29.7 cm. (DIN Size A4)
T	5.1 cm. (2")	2.5 cm. (1")	2.5 cm. (1")	2.5cm.
L	.64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	2.5 cm.
R	.64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	1.5 cm.
B	.64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	1.0 cm.

Margins do not conform to chart above. Sheet(s) 2, 3
X Top (T) X Left (L) ___ Right (R) ✓ Bottom (B)

7. VIEWS. 37 CFR 1.84(h)
   REMINDER: Specification may require revision to correspond to drawing changes.
   - ___ All views not grouped together. Fig(s)____
   - ___ Views connected by projection lines or lead lines. Fig(s)____
   - Partial views. 37 CFR 1.84(h) 2
   - ___ View and enlarged view not labled separatly or properly. Fig(s)____
   - Sectional views. 37 CFR 1.84 (h) 3
   - ___ Hatching not indicated for sectional portions of an object. Fig(s)____
   - ___ Cross section not drawn same as view with parts in cross section with regularly spaced parallel oblique strokes. Fig(s)____
8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)
   - ___ Words do not appear on a horizontal, left-to-right fashion when page is either upright or turned so that the top becomes the right side, except for graphs. Fig(s)____
9. SCALE. 37 CFR 1.84(k)
   - ___ Scale not large enough to show mechanism with crowding when drawing is reduced in size to two-thirds in reproduction. Fig(s)____
   - ___ Indication such as "actual size" or scale 1/2" not permitted. Fig(s)____
10. CHARACTER OF LINES, NUMBERS, & LETTERS. 37 CFR 1.84(l)
    - Lines, numbers & letters not uniformly thick and well defined, clean, durable, and black (except for color drawings). Fig(s) 1-4
11. SHADING. 37 CFR 1.84(m)
    - ___ Solid black shading areas not permitted. Fig(s)____
    - ___ Shade lines, pale, rough and blurred. Fig(s)____
12. NUMBERS, LETTERS, & REFERENCE CHARACTERS. 37 CFR 1.84(p)
    - Numbers and reference characters not plain and legible. 37 CFR 1.84(p)(1) Fig(s) 1-4
    - ___ Numbers and reference characters not oriented in same direction as the view. 37 CFR 1.84(p)(l) Fig(s)____
    - ___ English alphabet not used. 37 CFR 1.84(p)(2) Fig(s)____
    - ___ Numbers, letters, and reference characters do not measure at least .32 cm. (1/8 inch) in height. 37 CFR(p)(3) Fig(s)____
13. LEAD LINES. 37 CFR 1.84(q)
    - ___ Lead lines cross each other. Fig(s)____
    - ___ Lead lines missing. Fig(s)____
14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.84(t)
    - ___ Sheets not numbered consecutively, and in Arabic numerals, beginning with number 1. Sheet(s)____
15. NUMBER OF VIEWS. 37 CFR 1.84(u)
    - ___ Views not numbered consecutively, and in Arabic numerals, beginning with number 1. Fig(s)____
    - ___ View numbers not preceded by the abbreviation Fig. Fig(s)____
16. CORRECTIONS. 37 CFR 1.84(w)
    - ___ Corrections not made from prior PTO-948. Fig(s)____
17. DESIGN DRAWING. 37 CFR 1.152
    - ___ Surface shading shown not appropriate. Fig(s)____
    - ___ Solid black shading not used for color contrast. Fig(s)____

COMMENTS: - Character must not ~~[illegible]~~ be cut thru by structure Fig 1, 2

REVIEWER [signature] DATE 10/26/96

OFFICIAL

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3/12/98
JS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

FAX RECEIVED
MAR 11 1998
GROUP 2600

Group Art No. 2721
Examiner Daniel G. Mariam

Amendment

Bror O. Hultgren, III, et al.

Device Profiles For Use In A Digital Image Processing System

Serial No. 08/709,487

Filed: September 6, 1996

Certification of Facsimile Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office on the date shown below to Tel. No. (703) 308-5397.
March 10, 1998.

Name Donald F. Mofford Reg. No. 33,740

Signature [signature]

Date March 10, 1998

Assistant Commissioner
of Patents
Washington, D. C. 20231

Dear Sir:

AMENDMENT

In response to the Office Action dated December 12, 1997, please amend the above-referenced application as follows:

In the Claims

Please amend Claims 1, 9, 16 and 24 as follows:

5.6(2)

B

1. (Amended) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing a device dependent transformation of spatial information content of the image to said device independent color space.

5.6(3)

B2

9. (Amended) A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space in response to a color characteristic function describing added noise characteristics;

generating second data for describing a device dependent transformation of spatial information content of the image to said device independent color space in response to a spatial characteristic function describing image signal transform characteristics; and

combining said first and second data into the device profile.

5.6(4)

B3

16. (Amended) A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space in

response to a color characteristic function describing added noise characteristics; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image to said device independent color space ~~signal transform characteristics~~.

24. (Amended) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space.

REMARKS

The above-identified patent application has been amended and reconsideration and re-examination are hereby requested.

Applicants note the required drawing changes, and formal replacement drawings incorporating the changes will be submitted thereafter.

The Examiner rejected Claims 1, 9, 16 and 24 under 35 U.S.C. § 103 as being unpatentable over Laumeyer et al (5,572,632) in view of Spiegel et al (5,615,282).

The Examiner also rejected Claims 2-8, 10-15,17-23 and 25-31 under 35 U.S.C. § 103 as being unpatentable over Laumeyer et al in view of Spiegel et al as applied to claims 1, 9, 16, and 24 and further in view of Cottrell et al (5,694,484).

It is respectfully submitted that Claim 1, as amended, is patentable over Laumeyer et al in view of Spiegel et al, since Laumeyer et al in view of Spiegel et al neither describe nor suggest "first data for describing a device dependent transformation of color information content of the

image to a device independent color space; and second data for describing a device dependent transformation of spatial information content of the image to said device independent color space".

Dependent Claim 2 adds the limitation "wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics" to claim a further patentably distinct feature of the invention.

As Claims 3 through 8 depend from Claim 1 and cite additional structure, they too are allowable for analogous reasons.

It is respectfully submitted that Claim 9, as amended, is patentable over Laumeyer et al in view of Spiegel et al, since Laumeyer et al in view of Spiegel et al neither describe nor suggest the method of "generating first data for describing a device dependent transformation of color information content of the image to a device independent color space in response to a color characteristic function describing added noise characteristics; generating second data for describing a device dependent transformation of spatial information content of the image to said device independent color space in response to a spatial characteristic function describing image signal transform characteristics; and combining said first and second data into the device profile."

As Claims 10 through 15 depend from Claim 9 and cite additional steps, they too are allowable for analogous reasons.

Independent Claim 16 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest the combination of

"means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space in response to a color characteristic function describing added noise characteristics; and means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image to said device independent color space signal transform characteristics."

As Claims 17 through 23 depend from Claim 16 and cite additional structure, they too are allowable for analogous reasons.

Claim 24 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest a "device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space."

As Claims 25 through 31 depend from Claim 24 and cite additional structure, they too are allowable for analogous reasons.

Applicants also believe that the remaining references cited by the Examiner but not applied to the Claims neither describe nor suggest Applicants' invention.

Accordingly, re-examination and reconsideration are requested in view of the above amendment and remarks.

Respectfully submitted,

Donald F. Mofford
Registration No. 33,740
Attorney for the Applicant(s)

Polaroid Corporation
575 Technology Square
Cambridge, MA 02139
(781) 386-6432
March 10, 1998
Case No. 8166
DFM/pc

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN B	8166(RAS)

LM32/0602

POLAROID CORPORATION
PATENT DEPARTMENT
549 TECHNOLOGY SQUARE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM,D	
ART UNIT	**PAPER NUMBER**
2721	

DATE MAILED: 06/02/98

6

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)
*U.S. GPO: 1997-422-188/80031

1- File Copy

Office Action Summary	Application No. 08/709,487	Applicant(s) Hultgren III, et al.
	Examiner Daniel G. Marion	Group Art Unit 2721

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Response

A SHORTENED STATUTORY PERIOD FOR RESPONSE IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a response be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for response is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to respond within the set or extended period for response will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 3-11-98.

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-31 is/are pending in the application.

Of the above claim(s) ___ is/are withdrawn from consideration.

☐ Claim(s) ___ is/are allowed.

☒ Claim(s) 1-31 is/are rejected.

☐ Claim(s) ___ is/are objected to.

☐ Claim(s) ___ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on ___ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on ___ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number)___.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received:___.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ___

☒ Notice of References Cited, PTO-892

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Interview Summary, PTO-413

☐ Notice of Informal Patent Application, PTO-152

☐ Other ___

Office Action Summary

U. S. Patent and Trademark Office
PTO-326 (Rev. 3-97)

*U.S. GPO: 1997-417-381/62710

Part of Paper No. 6

Response to Arguments

1. Applicant's arguments with respect to claims 1-31 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 9, 16 ~~and~~ 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman (5,668,890) in view of Spiegel, et al (5,615,282).

With regard to claim 1, Winkelman discloses a method and an apparatus for electronic reproduction of images comprising:

First data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of (minus-spatial information content) of the image to the device independent color space (col. 2, lines 46-55; col. 4, line 66 - col. 5, line 6; col. 6, lines 10-14). Winkelman does not explicitly call for a transforming operation using a spatial information content of the image. However, this is taught by Spiegel (col. 33, line 44 - col. 34, line 8).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Spiegel, et al into Winkelman's system in order to transform the spatial characteristic of the color image.

Claim 9 is rejected the same as claim 1. Thus, argument analogous to that presented above for claim 1 is applicable to claim 9. As to combining the first and second data into the device profile, Applicant's attention is directed to (Figure 2, ##, 16 and 17).

Claim 16 is rejected the same as claim 1 except claim 16 is an apparatus claim. Thus, argument analogous to that presented above for claim 1 is applicable to claim 16.

Claim 24 is rejected the same as claim 1. Thus, argument similar to that presented above for claim 1 is applicable to claim 24.

4. Claims 2-8, 10-15, 17-23 and 25-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman in view of Spiegel, et al as applied to claims 1, 9, 16, and 24 above, and further in view of Cottrell, et al (5,694,484).

With regard to claim 2, Winkelman (as modified by Spiegel, et al) discloses all the claimed subject matter except explicitly calling for a first characteristic function describing added noise characteristics. However, this is taught by Cottrell, et al (abstract; column 18, lines 3-52).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Cottrell et al into Winkelman's (as modified by Spiegel, et al) system if no other reason than to have a function describing an additive noise characteristics.

Claims 3, 7, and 8 are rejected the same as claims 1 and 2. Thus, arguments similar to those presented above for claims 1 and 2 are applicable to claims 3, 7, and 8.

With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Johnston et al (US 5,682,442) Image-Processing System; Doi et al (US 5,224,177) High Quality Film Image Correction and Duplication Method and System; US Patent No. (5,583,656) to Gandhi, et al discloses methods and apparatus for attaching compressed look-up table (LUT) representations of N to M-dimensional transforms to image data and for processing image data utilizing the attached compressed LUTs.

Effective November 16, 1997, the Examiner handling this application will be assigned to a new Art Unit as a result of the consolidation into Technology Center 2700. See the forth coming Official Gazette notice dated November 11, 1997. For any written or facsimile communication submitted ON OR AFTER November 16,1997, this Examiner, who was assigned to Art Unit **2616**, will be assigned to Art Unit **2721**. Please include the new Art Unit in the caption or heading of any communication submitted after the November 16,1997 date. Your cooperation in this matter will assist in the timely processing of the submission and is appreciated by the Office.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

May 11, 1998

LEO H. BOUDREAU
SUPERVISORY PATENT EXAMINER
GROUP 2700

Notice of References Cited	Application No. 08/709,487	Applicant(s) Hultgren III, et al	
	Examiner Daniel G Mariam	Group Art Unit 2721	Page 1 of 1

U.S. PATENT DOCUMENTS

		DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
	A	5,583,656	12-10-96	Gandhi, et al	358	426
	B	5,668,890	9-16-97	Winkelman	382	167
	C					
	D					
	E					
	F					
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	K					
	L					
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FOREIGN PATENT DOCUMENTS

		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
	N						
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NON-PATENT DOCUMENTS

		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
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GAU 2721

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PTO/SB/29 (1/98)
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OIPE SEP - 2 1998 PATENT & TRADEMARK OFFICE

CONTINUED PROSECUTION APPLICATION (CPA) REQUEST TRANSMITTAL

Submit an original, and a duplicate for fee processing.
(Only for Continuation or Divisional applications under 37 CFR 1.53(d))

#7 9-10-98

CHECK BOX, if applicable: ☐ DUPLICATE

Address to:
Assistant Commissioner for Patents
Box CPA
Washington, DC 20231

Attorney Docket No.	8166
First Named Inventor	Bror O. Hultgren, III
Examiner Name	D. Mariam
Group / Art Unit	2721
Express Mail Label No.	

This is a request for a ☒ continuation or ☐ divisional application under 37 C.F.R. § 1.53(d), (continued prosecution application (CPA)) of prior application number 08 / 709,487, filed on September 06, 1996, entitled Device Profiles For Use In A Digital Image Processing System.

NOTES

FILING QUALIFICATIONS: *The prior application identified above must be a nonprovisional application that is either: (1) complete as defined by 37 C.F.R. § 1.51(b), or (2) the national stage of an international application in compliance with 35 U.S.C. 371. A Notice will be placed on a patent issuing from a CPA, except for reissues and designs, to the effect that the patent issued on a CPA and is subject to the twenty-year patent term provisions of 35 U.S.C. § 154(a)(2). Therefore, the prior application of a CPA may have been filed before, on or after June 8, 1995.*

C-I-P NOT PERMITTED: *A continuation-in-part application cannot be filed as a CPA under 37 C.F.R. § 1.53(d), but must be filed under 37 C.F.R. § 1.53(b).*

EXPRESS ABANDONMENT OF PRIOR APPLICATION: *The filing of this CPA is a request to expressly abandon the prior application as of the filing date of the request for a CPA. 37 C.F.R. § 1.53(b) must be used to file a continuation, divisional, or continuation-in-part of an application that is not to be abandoned.*

ACCESS TO PRIOR APPLICATION: *The filing of this CPA will be construed to include a waiver of confidentiality by the applicant under 35 U.S.C. 122 to the extent that any member of the public who is entitled under the provisions of 37 C.F.R. § 1.14 to access to, copies of, or information concerning, the prior application may be given similar access to, copies of, or similar information concerning, the other application or applications in the file jacket.*

35 U.S.C. 120 STATEMENT: *In a CPA, no reference to the prior application is needed in the first sentence of the specification and none should be submitted. If a sentence referencing the prior application is submitted, it will not be entered. A request for a CPA is the specific reference required by 35 U.S.C. 120 and to every application assigned the application number identified in such request. 37 C.F.R. § 1.78(a).*

1. ☐ Enter the unentered amendment previously filed on ____________ under 37 C.F.R. § 1.116 in the prior nonprovisional application.
2. ☒ A preliminary amendment is enclosed.
3. This application is filed by fewer than all the inventors named in the prior application, 37 C.F.R. § 1.53 (d)(4).
   a. ☐ *DELETE* the following inventor(s) named in the prior nonprovisional application:
   ....
   ....
   b. ☐ The inventor(s) to be deleted are set forth on a separate sheet attached hereto.
4. ☐ A new power of attorney or authorization of agent (PTO/SB/81) is enclosed.
5. Information Disclosure Statement (IDS) is enclosed:
   a. ☐ PTO-1449
   b. ☐ Copies of IDS Citations

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08709487

[Page 1 of 2]

Burden Hour Statement: This form is estimated to take 0.4 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box CPA, Washington, DC 20231.

Please type a plus sign (+) ins... this box → [+]

PTO/SB/29 (1/98)
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CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
	TOTAL CLAIMS (37 C.F.R. § 1.16(c) or (j))	31 -20* =	11	x $ 22 =	$ 242.00
	INDEPENDENT CLAIMS (37 C.F.R.§1.16(b) or (i))	4 -3** =	1	x $ 82 =	$ 82.00
	MULTIPLE DEPENDENT CLAIMS (if applicable) (37 C.F.R. § 1.16(d))			+ $ 0 =	
				BASIC FEE (37 C.F.R. §1.16)	$ 790.00
				Total of above Calculations =	
	Reduction by 50% for filing by small entity (Note 37 C.F.R. §§ 1.9, 1.27 & 1.28).				
	* *Reissue claims in excess of 20 and over original patent.* ** *Reissue independent claims over original patent.*			TOTAL =	$ 1,114.00

6. Small entity status:
   a. ☐ A small entity statement is enclosed, if (b) and (c) do not apply.
   b. ☐ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
   c. ☐ is no longer claimed.
7. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 16-2195 :
   a. ☒ Fees required under 37 C.F.R. § 1.16.
   b. ☒ Fees required under 37 C.F.R. § 1.17.
   c. ☒ Fees required under 37 C.F.R. § 1.18.
8. ☒ A check in the amount of $ 1,114.00 is enclosed.
9. ☐ Other: ....

NOTE: ***The prior application's correspondence address will carry over to this CPA UNLESS a new correspondence address is provided below.***

10. NEW CORRESPONDENCE ADDRESS

☐ *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or ☐ *New correspondence address below*

Name					
Address					
City		*State*		*Zip Code*	
Country		*Telephone*		*Fax*	

11. SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Name (Print/Type)	Donald F. Mofford
Signature	Donald F. Mofford
Registration No. (Attorney/Agent)	33,740
Date	September 02, 1998

[Page 2 of 2]

OIPE SEP - 2 1998 JCS PATENT & TRADEMARK

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney's Docket No.: **8166**

Group Art Unit: 2721
Examiner: D. Mariam

Application of: Bror O. Hultgren,III, et al.
Serial No.: 08/ 709,487
Filed: September 06, 1996
For: **DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM**

CERTIFICATE OF EXPRESS MAIL FILING

Cambridge, Massachusetts 02139
September 02, 1998

Honorable Assistant Commissioner for Patents
Box CPA
Washington, D.C. 20231

Dear Sir:

I hereby certify that a Continued Prosecution Application (CPA) Request Transmittal (Pages 1 and 2), Preliminary Amendment, Check No. 10238 in the amount of $ 1,114.00 for filing fee, Check No. 10238 and a post card is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service Mailing Label No.: **EE 226 611 827 US**, under 37 CFR 1.10 on the date indicated above and is addressed to Assistant Commissioner for Patents, Box CPA, Washington, D.C. 20231.

Respectfully submitted,

Donald F. Mofford
Registration No. 33,740

Polaroid Corporation
784 Memorial Drive
Cambridge, Massachusetts 02139
Tel: 781 386-6432
Fax: 781 386-6435

EE 226 611 827 US
#8
9-10-98
JB

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art No. 2721
Examiner Daniel G. Mariam

Preliminary Amendment

Bror O. Hultgren, III, et al.

Device Profiles For Use In A Digital Image Processing System

Serial No. 08/709,487

Filed: September 6, 1996

Assistant Commissioner
of Patents
Washington, D. C. 20231

Dear Sir:

PRELIMINARY AMENDMENT

In response to the Office Action dated June 2, 1998, reconsideration and re-examination are hereby requested.

The Examiner rejected Claims 1, 9, 16 and 24 under 35 U.S.C. § 103(a) as being unpatentable over Winkelman (5,668,890) in view of Spiegel et al (5,615,282).

The Examiner also rejected Claims 2-8, 10-15,17-23 and 25-31 under 35 U.S.C. § 103(a) as being unpatentable over Winkelman in view of Spiegel et al as applied to claims 1, 9, 16, and 24 and further in view of Cottrell et al (5,694,484).

It is Applicants understanding Winkelman teaches transforming the image value (R,G,B) of the first color space into functionally appertaining image values (L*,a*,b*) of a second color space that is independent of the first color space, and analysis of the image original for calculating setting values for the image processing is implemented with reference to the transformed image values (L*,a*,b*) of the second color space. (Col. 2, lines 47-55)

Applicants teach characterizing a device profile for a digital device comprising first data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial information content of the image to said device independent color space. The latter provides both chromatic characteristic information and spatial characteristic information of a device thus enhancing the capability of a digital image processing system to render an exact duplicate of an image.

It is respectfully submitted that Claim 1 is patentable over Winkelman in view of Spiegel et al, since Winkelman in view of Spiegel et al neither describe nor suggest "... <u>device profile</u> comprising: <u>first data for describing a device dependent transformation of color information content</u> of the image <u>to a device independent color space</u>; and <u>second data for describing a device dependent transformation of spatial information content</u> of the image <u>to said device independent color space</u>".

Dependent Claim 2 adds the limitation "wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics" to claim a further patentably distinct feature of the invention.

As Claims 3 through 8 depend from Claim 1 and cite additional structure, they too are allowable for analogous reasons.

It is respectfully submitted that Claim 9 is patentable over Winkelman in view of Spiegel et al, since Winkelman in view of Spiegel et al neither describe nor suggest the method of

"generating first data for describing a device dependent transformation of color information content of the image to a device independent color space in response to a color characteristic function describing added noise characteristics; generating second data for describing a device dependent transformation of spatial information content of the image to said device independent color space in response to a spatial characteristic function describing image signal transform characteristics; and combining said first and second data into the device profile."

As Claims 10 through 15 depend from Claim 9 and cite additional steps, they too are allowable for analogous reasons.

Independent Claim 16 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest the combination of "means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space in response to a color characteristic function describing added noise characteristics; and means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image to said device independent color space signal transform characteristics."

As Claims 17 through 23 depend from Claim 16 and cite additional structure, they too are allowable for analogous reasons.

Claim 24 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest a "device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an

image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space."

As Claims 25 through 31 depend from Claim 24 and cite additional structure, they too are allowable for analogous reasons.

Accordingly, re-examination and reconsideration are requested in view of the above amendment and remarks.

Respectfully submitted,

Donald F. Mofford
Registration No. 33,740
Attorney for the Applicant(s)

Polaroid Corporation
784 Memorial Drive
Cambridge, MA 02139
(781) 386-6432
September 2, 1998
Case No. 8166
DFM/pc

8M

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, DC 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN	B	8166(RAS)

LM02/1007

POLAROID CORPORATION
PATENT DEPARTMENT
549 TECHNOLOGY SQUARE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM, D	

ART UNIT	PAPER NUMBER
2721	9

DATE MAILED: 10/07/98

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (REV. 2/95)

1-File Copy

☆U.S.GOVERNMENT PRINTING OFFICE 1995-319-826

Office Action Summary	Application No. 08/709,487	Applicant(s) Hultgren, III, et al
	Examiner Daniel G. Mariam	Group Art Unit 2721

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Response

A SHORTENED STATUTORY PERIOD FOR RESPONSE IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a response be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for response is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to respond within the set or extended period for response will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 9-2-98.

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-31 is/are pending in the application.

Of the above claim(s) is/are withdrawn from consideration.

☐ Claim(s) is/are allowed.

☒ Claim(s) 1-31 is/are rejected.

☐ Claim(s) is/are objected to.

☐ Claim(s) are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) .

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received: .

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s).

☒ Notice of References Cited, PTO-892

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Interview Summary, PTO-413

☐ Notice of Informal Patent Application, PTO-152

☐ Other

Office Action Summary

U. S. Patent and Trademark Office
PTO-326 (Rev. 3-97)

*U.S. GPO: 1997-417-381/62710

Part of Paper No. 9

Continued Prosecution Application

1. The request filed on September 2, 1998, for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 08/709,487 is acceptable and a CPA has been established. An action on the CPA follows.

Response to Arguments

2. Applicant's preliminary amendment filed September 2, 1998, have been fully considered but they are not deemed to be persuasive for at least the following reasons.

Applicant generally argues, that neither Winkelman nor Spiegel, et discloses the limitations as recited in claims 1-31. Applicant points out, that . . . second data for describing for a device dependent transformation of spatial information content of the image to said device independent color space. The latter provides both chromatic characteristic information and spatial characteristic information of a device thus enhancing the capability of a digital image processing system to render an exact duplicate of an image.

Applicant's point is well taken. However, Spiegel, et al clearly teaches this feature (see the abstract, for example). More over, Winkelman teaches, at col. 6, lines 6-14, that the color values R, G, B of the device-specific RGB color space 14 of the input devices 1, 2, 3 are mathematically transformed into the reference color system 13 by suitable input calibration. The

color values X, Y, Z of the reference color system 13 are transformed by mathematically defined transformations into color values of a selectable, device-independent communication color space 15 with which the master analysis (i.e., frequency distribution for example) and the image processing can be carried out . The details of master analysis is described with respect to Fig. 3. Therefore, the combined teaching of Winkelman and Spiegel clearly meets Applicant's claimed invention.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

4. Claims 1 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Laumeyer, et al (5,572,632).

With regard to claim 1, Laumeyer, et al (hereinafter "Laumeyer") discloses first data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial information (i.e., size, resolution, spatial locations, etc....) of the image to the device independent color space (col. 8, line 4 - col. 10, line 17).

With regard to claim 24, as best understood, claim 1 encompasses the limitation of this claim and thus it is met by the prior art.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman (5,668,890) in view of Spiegel, et al (5,615,282).

With regard to claim 1, Winkelman discloses a method and an apparatus for electronic reproduction of images comprising:

First data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of (minus-spatial information content) of the image to the device independent color space (col. 2, lines 46-55; col. 4, line 66 - col. 5, line 6; col. 6, lines 10-14). Winkelman does not explicitly call for a device dependent transformation operation using a spatial information content of the image. However, this feature is taught by Spiegel (col. 33, line 44 - col. 34, line 8; col. 34, lines 5-9). Also, Applicant's attention is invited to paragraph 2 above.

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Spiegel, et al into Winkelman's system in order to transform the spatial characteristic of the color image.

Claim 9 is rejected the same as claim 1. Thus, argument analogous to that presented above for claim 1 is applicable to claim 9. The limitation "added noise" is considered inherent in Spiegel et al system, because modifying the spatial and color characteristics of the digital image clearly involves a noise as modifying process is carried out in response to the characteristics of the images, to preserve the color of the original image (col. 9, lines 11-31; abstract; col. 5, lines 29-49; , for example). As to combining the first and second data into the device profile (see Figure 2, ##, 16 and 17).

Claim 16 is rejected the same as claims 1 and 9 except claim 16 is an apparatus claim. Thus, arguments analogous to those presented above for claims 1 and 9 are applicable to claim 16.

Claim 24 is rejected the same as claim 1. Thus, argument similar to that presented above for claim 1 is applicable to claim 24.

7. Claims 2-8, 10-15, 17-23 and 25-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman in view of Spiegel, et al as applied to claims 1, 9, 16, and 24 above, and further in view of Cottrell, et al (5,694,484).

With regard to claim 2, Winkelman (as modified by Spiegel, et al) discloses all the claimed subject matter except explicitly calling for a first characteristic function describing added noise characteristics. However, this is taught by Cottrell, et al (abstract; column 18, lines 3-52).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Cottrell et al into Winkelman's (as modified by Spiegel, et al) system if no other reason than to have a function describing an additive noise characteristics.

Claims 3, 7, and 8 are rejected the same as claims 1 and 2. Thus, arguments similar to those presented above for claims 1 and 2 are applicable to claims 3, 7, and 8.

With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. (5,257,097) to Pineau, et al discloses method and apparatus for selective interception of a graphics rendering operation for effecting image data modification; US Patent No. (5,450,216) to Kasson discloses color image gamut-mapping system with chroma enhancement at human-insensitive spatial frequencies; and a publication to Murch discloses "New Paradigms for Visualization".

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

September 30, 1998

BIPIN SHALWALA
PATENT EXAMINER
GROUP 2800

Notice of References Cited	Application No. 08/709,487	Applicant(s) HULTGREN, III, et al
	Examiner Daniel G. Mariam	Group Art Unit 2721 — Page 1 of 1

U.S. PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
	A	5,257,097	10-26-93	Pineau, et al	358	527
	B	5,450,216	9-12-95	Kasson	358	518
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
	N						
	O						
	P						
	Q						
	R						
	S						
	T						

NON-PATENT DOCUMENTS

*		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
	U	Murch "New Paradigms for Visualization," IEEE, pp. 550-551	1990
	V		
	W		
	X		

* A copy of this reference is not being furnished with this Office action.
(See Manual of Patent Examining Procedure, Section 707.05(a).)

U.S. Patent and Trademark Office
PTO-892 (Rev. 9-95)

Part of Paper No. 9

*U.S. GPO: 1997-417-381/62700

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
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Washington, D.C. 20231

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2721

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LOCATION 27C1 SERIAL NUMBER 08709487 PATENT NUMBER

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POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

AND THE PRACTITIONERS OF RECORD FOR CUSTOMER NUMBER 20349 ARE:

24359	24359	25173	25173	25778	25778	25937	25937	26378	26378
29629	29629	33740	34442	34442	35344	36780	36780	40049	40256
42562	42562								

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TALBOT-1/97

SENT BY:POLAROID ; 2- 8-99 ; 17:32 ; 6173866435→ 7033085397;# 6

#11
2-10-99
MJC

IN THE UNITED STATES PATENT AND RADEMARK OFFICE

Group Art Unit 2721
Examiner Daniel G. Mariam

Petition for Extension of Time

Bror O. Hultgren, III, et al.
Device Profiles For Use In A Digital Image Processing System
Serial No. 08/709,487
Filed: September 6, 1996

OFFICIAL

Certification of Facsimile Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office on the date shown below to Tel. No. (703) 308-5397.

February 8, 1999

Name Donald F. Mofford Reg. No. 33,740

Signature Donald F. Mofford

Date February 8, 1999

FAX RECEIVED
FEB 9 1999
Group 2700

Assistant Commissioner of Patents
Washington, DC 20231

Sir:

PETITION FOR AN EXTENSION OF TIME UNDER 37 CFR 1.17(a)

Applicants hereby petition for an extension of time under 37 CFR 1.17(a) to extend the 3 month statutory period one (1) month to February 7, 1999 for the response to the Office Action dated October 7, 1998, which was due on January 7, 1999.

Authorization is hereby given to charge the amount of $110.00 and to charge any excess fees or credit any overpayment to Polaroid Deposit Account No. 16-2195.

Respectfully Submitted,

Donald F. Mofford
Donald F. Mofford
Registration No. 33,740
Attorney for the Applicants

Polaroid Corporation
Cambridge MA 02139
(781) 386-6432
February 8, 1999
Case No. 8166

02/10/1999 MCOLEMAN 00000002 162195 08709487
01 FC:115 110.00 CH

#12
2-10-99

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Group 2700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Amendment

Group Art No. 2721
Examiner Daniel G. Mariam

Bror O. Hultgren, III, et al.

Device Profiles For Use In A Digital Image Processing System

Serial No. 08/709,487

Filed: September 6, 1996

Assistant Commissioner
of Patents
Washington, D. C. 20231

Post-it® Fax Note 7671	Date 2-8-99 # of pages ▸ 6
To Examiner Mariam	From Don Mofford
Co./Dept.	Co.
Phone #	Phone #
Fax # 703-308-5397	Fax #

Certification of Facsimile Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office on the date shown below to Tel. No. (703) 308-5397.
February 8, 1999.

Name Donald F. Mofford Reg. No. 33,740

Signature [signature]

Date February 8, 1999

Dear Sir:

AMENDMENT

In response to the Office Action dated October 7, 1998, reconsideration and re-examination are hereby requested.

The Examiner rejected Claims 1 and 24 under 35 U.S.C. § 102(e) as being anticipated by Laumeyer et al. (5,572,632).

The Examiner also rejected Claims 1, 9, 16 and 24 under 35 U.S.C. § 103(a) as being unpatentable over Winkelman (5,668,890) in view of Spiegel et al (5,615,282).

The Examiner also rejected Claims 2-8, 10-15,17-23 and 25-31 under 35 U.S.C. § 103(a) as being unpatentable over Winkelman in view of Spiegel et al as applied to claims 1, 9, 16, and 24 and further in view of Cottrell et al (5,694,484).

It is Applicants belief that Applicant is the first to provide a device profile comprising data for describing spatial information of a device in the profile in device independent space. It is recognized that color and space information for device dependent space has been utilized, but not spatial information for device independent color space.

The Examiner suggests that Laumeyer teaches a device profile. Applicants respectfully submit that Laumeyer teaches a process and neither describes not suggests creating a device profile. Thus claims 1 and 24 are not anticipated by Laumeyer et al., since Laumeyer does not teach a device profile.

The Examiner suggests that Winkelman in view of Spiegel et al teaches the invention claimed in Claims 1, 9, 16 and 24. Applicants respectfully submit that Winkelman teaches color information transformation, but not spatial information transformation as also recognized by the Examiner. The Examiner suggests that this feature is taught by Spiegel. Applicants respectfully submit that Applicants claim a "device profile comprising ... second data for describing a device dependent transformation of spatial information content of the image to said device independent color space" a feature not suggested by Spiegle. Again Spiegle is teaching a process, not a device profile with the above claimed feature.

Applicants teach characterizing a device profile for a digital device comprising first data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial information content of the image to said device independent color space. The latter provides both chromatic characteristic information and spatial characteristic information of a device thus enhancing the capability of a digital image processing system to render an exact duplicate of an image.

It is respectfully submitted that Claim 1 is patentable over Laumeyer et al or Winkelman in view of Spiegel et al, since Laumeyer et al or Winkelman in view of Spiegel et al neither describe nor suggest "... device profile comprising: ... second data for describing a device dependent transformation of spatial information content of the image to said device independent color space".

As Claims 2 through 8 depend from Claim 1 and cite additional structure, they too are allowable for analogous reasons and for reasons previously stated

It is respectfully submitted that Claim 9 is patentable over Laumeyer et al or Winkelman in view of Spiegel et al, since Laumeyer et al or Winkelman in view of Spiegel et al neither describe nor suggest the method of generating a device profile comprising " ... generating second data for describing a device dependent transformation of spatial information content of the image to said device independent color space in response to a spatial characteristic function describing image signal transform characteristics; and combining said first and second data into the device profile."

As Claims 10 through 15 depend from Claim 9 and cite additional steps, they too are

allowable for analogous reasons.

Independent Claim 16 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image to said device independent color space signal transform characteristics."

As Claims 17 through 23 depend from Claim 16 and cite additional structure, they too are allowable for analogous reasons.

Claim 24 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest a "device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space."

As Claims 25 through 31 depend from Claim 24 and cite additional structure, they too are allowable for analogous reasons.

Applicants have submitted herewith a Petition for an Extension of Time for one month with authorization to charge Polaroid Corporation Deposit Account No. 16-2195 the fee of $110.00 and for any excess fees due or credit any overpayment.

Accordingly, re-examination and reconsideration are requested in view of the above amendment and remarks.

Respectfully submitted,

Donald F. Mofford
Registration No. 33,740
Attorney for the Applicant(s)

Polaroid Corporation
784 Memorial Drive
Cambridge, MA 02139
(781) 386-6432
February 8, 1999
Case No. 8166
DFM/pc

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN B	8166(RAS)

020349 LM01/0414
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM,D	
ART UNIT	PAPER NUMBER
2721	13

DATE MAILED: 04/14/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)

1- File Copy

Office Action Summary	Application No. 08/709,487	Applicant(s) HultGren III, et al
	Examiner Daniel G. Mariam	Group Art Unit 2721

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 2-8-99.

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-31 is/are pending in the application.

Of the above claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) 1-31 is/are rejected.

☐ Claim(s) ______ is/are objected to.

☐ Claim(s) ______ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on ______ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☒ Notice of Reference(s) Cited, PTO-892

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Interview Summary, PTO-413

☐ Notice of Informal Patent Application, PTO-152

☐ Other ______

Office Action Summary

U. S. Patent and Trademark Office
PTO-326 (Rev. 9-97)

*U.S. GPO: 1997-433-221/62717

Part of Paper No. 13

Response to Amendment

1. Applicant's arguments with respect to claims 1-31 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stokes (5,881,209) in view of Stokes (hereinafter "ST2) (5,634,092).

With regard to claim 1, Stokes discloses a method and system for automatically generating printer profiles comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space ; and second data for describing a device dependent transformation of spatial information of the image to the device independent color space (col. 5, lines 18-23).

Stokes further teaches a color utility which can include a set of routines and data structures that enable color processing system 26 to match colors and communicate color information between the various source and destination devices..... Color information described in a color profile includes data relating to the device's color space, gamut, tonal reproduction curves, and the preferred color matching method model (col. 4, lines 34-44).

Stokes does not explicitly disclose spatial information content of the image. However, this feature is taught by ST2 (col. 2, lines 4-13; col. 6, lines 47-53).

Stokes and ST2 are combinable because they are from a similar problem solving area, i.e., transferring image data from one device to another, in accordance with the respective color profile of the two devices (col. 3, lines 47-50, for example). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of ST2 with Stokes. The motivation for doing so is to provide spatial content of the image and to allow more efficient processing, and lower input/output processing (col 2, lines 2-65; col. 6, lines 51-53 of ST2). Therefore, it would have been obvious to combine ST2 with Stokes to obtain the invention as specified in claim 1.

With regard to claim 24, as best understood, claim 1 encompasses the limitation of this claim and thus it is met by the prior art.

4. Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman (5,668,890) in view of Ohtsuka, et al (5,606,432).

With regard to claim 1, Winkelman discloses a method and an apparatus for electronic reproduction of images comprising:

First data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial information content of the image to the device independent color space (col. 2, lines 46-55; col. 4, line 66 - col. 5, line 6; col. 6, lines 10-14). Winkelman does not explicitly call for a device dependent transformation operation using a spatial information content of the image. However, this feature, i.e., resolution, noise, for example, is taught by Ohtsuka, et al (col. 1, line 41 - col. 2, line 37; col. 5, lines 27-60).

Winkelman and Ohtsuka, et al are combinable because they are from a similar problem solving area, i.e., generating device profile (#18, Fig. 1). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Ohtsuka, et al with Winkelman. The motivation for doing so is to provide a color image reproducing system which is capable of reproducing a simulated image on a monitor device whose appearance agrees highly accurately with an image on a printed material by taking into account periodic noise or random noise introduced in the printed image (col. 2, lines 2-7 of Ohtsuka, et al). Therefore, it would have been obvious to combine Ohtsuka, et al with Winkelman to obtain the invention as specified in claim 1.

Claim 9 is rejected the same as claim 1. Thus, argument analogous to that presented above for claim 1 is applicable to claim 9. As to describing an added noise characteristics, this

feature is clearly taught by Ohtsuka, et al (col. 13, lines 14-51). Also, as to combining the first and second data into the device profile (see Figure 2, ##, 16 and 17 of Winkelman).

Claim 16 is rejected the same as claims 1 and 9 except claim 16 is an apparatus claim. Thus, arguments analogous to those presented above for claims 1 and 9 are applicable to claim 16.

Claim 24 is rejected the same as claim 1. Thus, argument similar to that presented above for claim 1 is applicable to claim 24.

5. Claims 2-8, 10-15, 17-23 and 25-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman in view of Ohtsuka, et al applied to claims 1, 9, 16, and 24 above, and further in view of Cottrell, et al (5,694,484).

With regard to claim 2, Winkelman (as modified by Ohtsuka, et al) discloses all the claimed subject matter except explicitly calling for a first characteristic function describing added noise characteristics. However, this is taught by Cottrell, et al (abstract; column 18, lines 3-52).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Cottrell et al into Winkelman's (as modified by Ohtsuka, et al) system if for no other reason than to have a function describing an additive noise characteristics.

Claims 3, 7, and 8 are rejected the same as claims 1 and 2. Thus, arguments similar to those presented above for claims 1 and 2 are applicable to claims 3, 7, and 8.

With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. (5,646,752) to Kohler, et al discloses color image processing apparatus which uses private tags to alter a predefined color transformation sequence of a device profile; US Patent No. (5,838,333) to Matsuo discloses image processing device and image processing method.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

April 11, 1999

Phuoc Tran

PHUOC TRAN
PRIMARY EXAMINER

Notice of References Cited	Application No. 08/709,487	Applicant(s) Hultgren III, et al	
	Examiner Daniel G. Mariam	Group Art Unit 2721	Page 1 of 1

U.S. PATENT DOCUMENTS

	DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
A	5,608,432	2-25-97	Ohtsuka, et al	358	527
B	5,634,092	5-27-97	Stokes	345	418
C	5,646,752	7-8-97	Kohler, et al	358	520
D	5,838,333	11-17-98	Matsuo	345	431
E	5,881,209	3-9-99	Stokes	358	504
F					
G					
H					
I					
J					
K					
L					
M					

FOREIGN PATENT DOCUMENTS

	DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
N						
O						
P						
Q						
R						
S						
T						

NON-PATENT DOCUMENTS

	DOCUMENT (including Author, Title, Source, and Pertinent Pages)	DATE
U		
V		
W		
X		

U. S. Patent and Trademark Office
PTO-892 (Rev. 9-95) Notice of References Cited Part of Paper No. 13

Docket No. C-8166/RJD

OIPE JC78 JUL 19 1999 PATENT & TRADEMARK OFFICE

PATENT

#14/c KD 7-27-99

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.: 08/709,487
Filed: September 6, 1996
By: Hultgren et al.
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Art Unit: 2721
Examiner: D. Mariam

Assistant Commissioner for Patents
Washington, D.C. 20231

CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to Assistant Commissioner for Patents, Washington, D.C. 20231.

Date: July 14, 1999

Robert J. Decker
Registration No. 44,056

RECEIVED JUL 23 1999 TECH CENTER 2700

AMENDMENT UNDER 37 C.F.R § 1.115

Sir:

In response to the Office Action dated April 14, 1999, having a three (3) month shortened statutory period set to expire July 14, 1999, please amend the above captioned application as follows:

IN THE SPECIFICATION:

Page 3, line 8: after "both" insert --the measured--;

line 8: after "chromatic" insert --response--; and

line 8: replace "characteristic functions" with --stimuli and device response--.

lines 9-10: replace "characteristics of a processed image" with --characteristic functions of an imaging element or device--.

C1

Page 8, line 4: replace existing equation " M'(u,v) = K(u,v) * M(u,v) " with the equation as follows -- M"(u,v) = K_i(u,v) * M(u,v) --; and

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01 FC:103 36.00 OP

Serial No. 08/709,487
Docket No. C-8166/RJD

line 5: replace existing equation " $N''(u,v) = K^2(u,v) * N(u,v) + N(u,v)$ " with the equation as follows -- $N''(u,v) = K_i^2(u,v) * N(u,v) + N_i(u,v)$ --.

IN THE CLAIMS:

Please amend claims 1, 9, 10, 11, 12, 14, 16, and 24 as follows:

C 2

1. (TWICE AMENDED) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

coordinate

second data for describing [a] device dependent [transformation of] spatial information content of the image [to] in said device independent color space.

C 3

9. (TWICE AMENDED) A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space [in response to a color] through use of measured chromatic stimuli and device response characteristic [function describing added noise characteristics] functions;

generating second data for describing [a] device dependent [transformation of] spatial information content of the image [to] in said device independent color space through use of [in response to a] spatial stimuli and device response characteristic [function describing image signal transform characteristics] functions; and

combining said first and second data into the device profile.

C 4

12
~~10~~. (AMENDED) The method of claim [9] ~~13~~ 11 wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

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Serial No. 08/709,487
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13 ~~11~~. (AMENDED) The method of claim [9] 11 ~~33~~ wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

C4

C4 cont'd

14 ~~12~~. (AMENDED) The method of claim [9] 11 ~~33~~, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

C5

16 ~~14~~. (AMENDED) The method of claim [9] 11 ~~33~~, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

Sub 3

C6

~~16. (TWICE AMENDED) A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:~~

~~means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space [in response to a color] through use of chromatic response characteristic [function] functions; and~~

~~means for utilizing second data of the device profile for describing [a] device dependent [transformation of] spatial information content of the image in said device independent color space [in response to a] through the use of spatial characteristic [function describing image to said device independent color space signal transform characteristics] functions describing image spatial transform characteristics in said device independent color space.~~

Sub 4

C7

~~24. (TWICE AMENDED) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing [a] device dependent [transformation of] spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.~~

Please add the new claims 32 and 33 as follows.

9 ~~32~~. (NEW) The device profile of claim 1 wherein, for said device, the second data is generated through use of spatial stimuli and device response characteristic functions.

C8

20

-3-

Serial No. 08/709,487
Docket No. C-8166/RJD

33. (NEW) The method of claim 9 wherein, for said device:

the first data is represented by a color characteristic function describing added noise characteristics; and

the second data is represented by a spatial characteristic function describing image signal transform characteristics.

IN THE ABSTRACT:

Page 14, lines 2-12: replace the existing Abstract with the paragraph as follows.

-- Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured chromatic response and spatial stimuli and device response functions within a model based image processing system to predict both color and spatial characteristic functions on an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.--

REMARKS

I. STATUS OF THE CLAIMS

Claims 1-33 are pending in the application.

Claims 1, 9, 16, and 24 are independent claims.

Claims 1-31 stand rejected under 35 U.S.C. § 103.

New dependent claims 32 and 33 have been added.

II. AMENDMENTS

The specification and the abstract has been amended to correct obvious informalities and to clarify the invention.

New claim 32 further clarifies the invention and new claim 33 is similar to original claim 2.

It is believed that the amendments do not involve the addition of any new matter.

III. IN THE DRAWINGS

To correct obvious informalities and to clarify the invention, Applicants have revised Fig. 4, as illustrated by the "redline" drawings enclosed herewith, so as to be consistent with revised equation nos. 8 and 9 of page 8 of the specification.

Applicants respectfully request approval of the proposed corrections.

The revisions to the drawings are believed to add no new matter.

IV. AMENDED CLAIMS 1 AND 24 ARE PATENTABLE UNDER 35 U.S.C. § 103 OVER STOKES 5,881,209 IN VIEW OF STOKES 5,634,092 BECAUSE THE APPLIED PRIOR ART TAKEN AS A WHOLE FAILS TO SUGGEST THE APPLICANTS' INVENTION

Claims 1 and 24 are rejected under 35 U.S.C. § 103 as being unpatentable over Stokes U.S. Patent 5,881,209 (hereinafter "Stokes") in view of Stokes U.S. Patent 5,634,092 (hereinafter "ST2").

Applicants respectfully submit that claims 1 and 24 would not have been obvious under 35 U.S.C. § 103 over Stokes in view of ST2 because the applied prior art fails to teach or suggest the device profile intended for a image reproduction system for capturing, transforming, or rendering an image as recited in base claims 1 and 24, respectively, which calls for:

> ...second data for describing <u>device dependent spatial information content of the image in said device independent color space</u>.

> ...said device profile comprising data for describing <u>device dependent spatial information content of the image in a device independent color space</u>, wherein through use of spatial stimuli and device response for said device, said data is represented by characteristic functions.

The Examiner suggests that the primary reference Stokes discloses color information described in a color profile including data relating the device's color space, but does not teach the spatial information content of the image.

Next, with regards to the secondary reference ST2, ST2 discloses processing algorithms that are being called which can be either color or spatial. ST2 provides:

> a single interface, or bottleneck, which obviates the need to bundle specific types of functionality with individual application programs. This approach allows for distributed processing, more efficient processing, and lower input/output requirements.

(col. 6, lines 47-53). However, it is known in the art that many complex imaging processing programs will follow some type of application process interface (API). The ST2 API includes an architecture that calls both color matching algorithms which operate on a point-wise basis and spatial algorithms which operate on a neighborhood basis. Generally, point-wise operations involve reading pixels or screening pixels and these point operations are read one pixel at a time. Whereas, with neighborhood operations, the image needs to be read in by some pixel band or pixel strip because it requires a group of pixels to be resident in memory at one point in time, so that one pixel is processed with reference to its neighboring pixels. The architecture needs to be flexible to accomplish both.

The ST2 API provides flexible enough architecture to support both spatial algorithms and color algorithms. ST2 API essentially initiates (i.e., runs, launches , or enables) the various algorithms. For example, depending on the set of instructions that is provided to the API, e.g., desired coloring, sharpening, noise-reduction, or compression, the API will manage the color or spatial algorithms. Or stated differently:

> As a result, the user is not forced to process the image with one application to obtain one result, e.g. unsharp masking, and then use a different program to obtain yet another service, such as image compression. Rather, the user is provided with a single coherent interface through which all available image processing services can be accessed.

(col. 5, lines 9-15).

In contrast, the present invention provides the actual data which the spatial algorithm requires for processing. The present invention pertains to the required information that is

actually being supplied to the spatial algorithm, i.e., the present invention provides a means for providing the data. Whereas ST2 is providing a means for turning a given Algorithm on or off, i.e., launching or enabling a given algorithm. For example, in order to run a color matching algorithm, it requires a data structure. Thus, one of the distinguishing features of the present invention (compared to ST2) is that the present invention actually provides the data required for the operation. The present invention's device profile is generated by use of both the measured chromatic and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device.

In summary, the Examiner's reliance on ST2's multiple image processing operations through a single interface does not supply the deficiencies of the Stokes disclosure vis-à-vis Applicants' base claims 1 and 24. Accordingly, neither ST2, nor Stokes taken alone, or in combination, would have suggested Applicants' invention of base claims 1 and 24. Claims 2-8, 32, and 25-31 are dependent from claims 1 and 24, respectively, and include all the limitations of the latter claims. A dependent claim contains all the limitations of the independent claim upon which it depends and is non-obvious under Federal Circuit guidelines if the independent claim upon which it depends is allowable.

Hence, it is Applicants' position that the cited art as a whole fails to teach or suggest the claimed invention within the meaning of 35 U.S.C. § 103 and request that the rejection of claims 1-8, and 24-32 be withdrawn.

V. AMENDED CLAIMS 1, 9, 16, AND 24 ARE PATENTABLE UNDER 35 U.S.C. § 103 OVER WINKELMAN IN VIEW OF OHTSUKA ET AL.; AND CLAIMS 2-8, 10-15, 17-23, AND 25-33 ARE PATENTABLE OVER WINKELMAN AND OHTSUKA ET AL. FURTHER IN VIEW OF COTTRELL ET AL. BECAUSE THE APPLIED PRIOR ART TAKEN AS A WHOLE FAILS TO SUGGEST THE APPLICANTS' INVENTION

Base claims 1, 9, 16, and 24 are rejected under 35 U.S.C. § 103 as being unpatentable over Winkelman U.S. Patent 5,668,890 in view of Ohtsuka et al. U.S. Patent 5,606,432 ("Ohtsuka"); as well as claims 2-8, 10-15, 17-23, and 25-31 over Winkelman and Ohtsuka further in view of Cottrell et al. U.S. Patent 5,694,484 ("Cottrell").

Applicants respectfully submit that base claims 1, 9, 16, and 24 would not have been obvious under 35 U.S.C. § 103 over Winkelman in view of Ohtsuka because the applied prior art fails to teach or suggest the following of the present invention:

a) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 1 which calls for:

> ...second data for describing <u>device dependent spatial information content of the image in said device independent color space</u>.

b) a method intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 9 which calls for:

> ...generating second data for describing <u>device dependent spatial information content of the image in said device independent color space</u> through use of spatial stimuli and device response characteristic functions;

c) an image processing system for capturing, transforming, or rendering an image, as recited in amended base claim 16 which calls for:

> ...means for utilizing second data of the device profile for describing <u>device dependent spatial information content of the image in said device independent color space</u> through the use of spatial characteristic functions describing image spatial transform characteristics in said device independent color space.

d) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 24 which calls for:

> ...said device profile comprising data for describing <u>device dependent spatial information content of the image in a device independent color space</u>, wherein through use of spatial stimuli and device response for said device, said data is represented by characteristic functions.

The Examiner suggests that primary reference Winkelman discloses transformation color information content of the image, but does not teach the operation using a spatial information content of the image.

Next, with regards to the secondary reference Ohtsuka, Ohtsuka discloses a system of providing data which enables an algorithm to add noise, i.e., a noise generating algorithm, in a manner that is appropriate to what the system determines the output image is going to look like.

For introduction purposes, it is noted that the goals of the present invention is quite different than the goal of Ohtsuka's invention, whereby the goal of Ohtsuka's invention is as follows: to enable the simulation of the appearance of a printed image (from a printing press) on another medium (i.e., "proofing" in the jargon of the industry). If the simulation is carried out to a CRT it is a "soft proof." If it is carried out on another type of printer, e.g., thermal printer or inkjet, it is called a "hard proof." Proofs have often been criticized because, while they may give the correct color impression, they fail to give the correct noise impression of the image being proofed as it will appear off the printing press. Therefore, Ohtsuka sought to include a simulation of those noise effects in his proofing image processing.

Whereas, one on the goals of the present invention is to codify the image information necessary to allow automatic image processing and quality optimization in an open system environment including input devices such as scanners, cameras, and computers; display devices like CRTs; output devices such as digital printers and film recorders; and even imaging processing operations such as sharpening, resizing, compressing, etc..

To enable the Ohtsuka simulation, Ohtsuka developed something referred to as a "profile" which organized and stored those characteristic noise features of the printing press being simulated. On the other hand with regards to the present invention, to enable optimization, the Applicants developed something referred to as a "profile" which contains an abstract description of the spatial response properties of any device in question (i.e., input device, display device, or output device; noise response and sharpness response).

However, the information Ohtsuka requires is necessarily very low level and tied to the specific properties of the printing press being simulated (e.g., screen ruling, dot shape, ink formulation, etc of Fig. 4 of Ohtsuka.). These properties do not at all apply to input devices or image processing operations.

As such, in the context of Fig. 7 of Ohtsuka:

> The color image data thus obtained are then outputted as a hard copy or displayed on the CRT by the image output unit 14A in a step S13. The operator confirms the outputted/displayed simulated color image in a step S14. If the operator sees no problem with respect to colors, etc., then the operator operates the image output unit 14B to produce a printed material in a step S15. If there is a problem, then the color image data are processed again in the image editor 12, printing conditions are modified, if necessary, and produced YMCK halftone dot percentage data are monitored repeatedly in the step S14.

(col. 13, lines 34-44).

In contrast, to be general enough for all devices and image processing operations, the present invention requires noise and sharpness descriptions that are not tied to any particular technology. The value of such general requirements of the present invention is neither disclosed nor suggested by Ohtsuka, or the applied prior art. The value of the present invention's general requirements derives from the automation made possible by placing all devices and image processing operations on a common basis so that image content can be modeled and image quality can be calculated and optimized.

In contrast, the present invention ties the profiles to the device and generates the profile by the process of the spatial stimuli and response functions within a model based image processing system to predict the spatial characteristic functions. The present invention characterizes any device or imaging element (whereas Ohtsuka describes the data), thus enabling spatial image processing in an open system.

In summary, the Examiner's reliance on Ohtsuka's image reproduction system does not supply the deficiencies of the Winkelman disclosure vis-à-vis Applicants' base claims 1, 9, 16, and 24. Accordingly, neither Ohtsuka, nor Winkelman taken alone, or in combination, would have suggested Applicants' invention of base claims 1, 9, 16, and 24. Claims 2-8, 32, 10-15, 33, 17-23, and 25-31 are dependent from claims 1, 9, 16, and 24, respectively, and include all the limitations of the latter claims. A dependent claim contains all the limitations of the independent claim upon which it depends and is non-obvious under Federal Circuit guidelines if the independent claim upon which it depends is allowable.

VI. CONCLUSION

Please charge any excess fees due and credit any overpayment to Charge Account No. 16-2195.

It should be noted that the above arguments are directed towards certain distinctions between the claims and the prior art cited which the Applicants believe make the pending claims patentable. However, the differences between the pending claims and the prior art cited is not necessarily limited to those distinctions.

Serial No. 08/709,487
Docket No. C-8166/RJD

For the foregoing reasons, Applicants respectfully submit that amended claims 1-31, and new claims 32 and 33, are in condition for allowance, and a notice for allowance is solicited.

Respectfully submitted,

7/14/99

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

Tel: 781-386-6474
Fax: 781-386-6435

\\NORFILE1\LEGAL\Patent\Cases\8166 RJD\REV2~8166-AMD-115.doc

Serial: 08/709,487
Attorney: C 8166

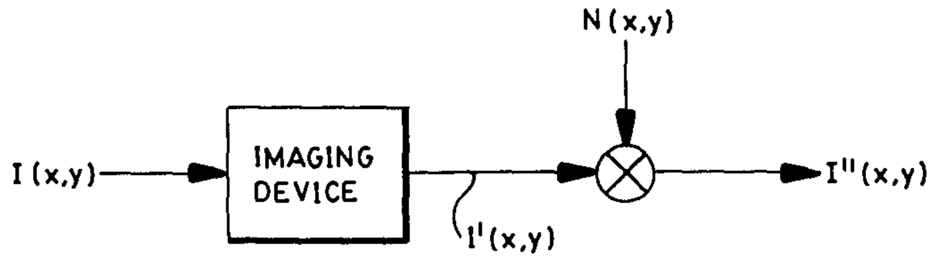

FIG. 3

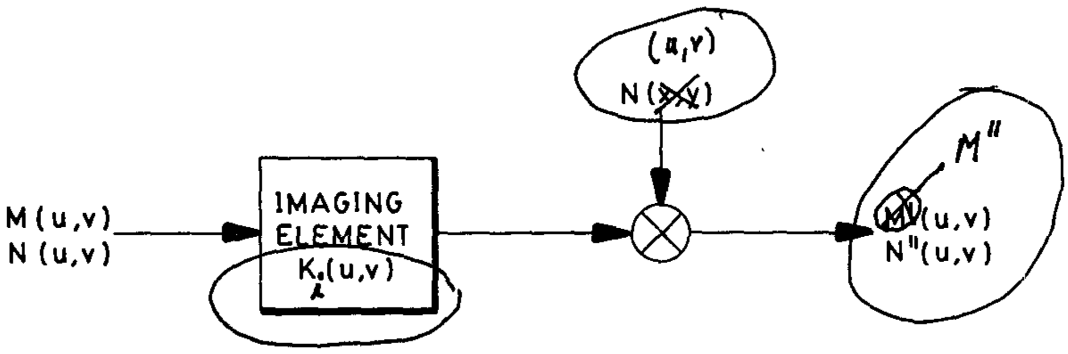

FIG. 4

GP 2721

Docket No. C-8166/RJD

OIPE JC78 JUL 19 1999 PATENT & TRADEMARK OFFICE

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.: 08/709,487
Filed: September 6, 1996
By: Hultgren et al.
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Art Unit: 2721
Examiner: D. Mariam

CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to Assistant Commissioner for Patents, Washington, D.C. 20231.

Date: July 14, 1999

Robert J. Decker
Registration No. 44,056

RECEIVED JUL 23 1999 TECH CENTER 2700

Assistant Commissioner for Patents
Washington, D.C. 20231

FEE CALCULATION FOR ADDITIONAL CLAIMS

Sir:

Transmitted herewith is an amendment in the above-identified application. The fee has been calculated as shown below.

CLAIMS AS AMENDED

	Claims Remaining After Amendment		Highest Number Previously Paid For	Present Extra	Rate	Additional Fee
Total Claims	33	Minus	31	2	× 18.00	36.00
Independent Claims	4	Minus	4	0	× 78.00	0
Total additional fee for this amendment						36.00

Check No. 10590 in the amount of $36.00 is attached. Please charge any additional fee due, or credit any excess fee paid to deposit account number 16-2195. A duplicate copy of this paper is enclosed.

Respectfully submitted,

7/14/99

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

Tel: 781-386-6474
Fax: 781-386-6435

G:\Patent\Cases\8166 RJD\8166AddClaimsFee.DOC

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Patent and Trademark Office
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Washington, D.C. 20231

J.N

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN B	8166(RAS)

020349 LM31/0924
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM, D	
ART UNIT	PAPER NUMBER
2721	15

DATE MAILED: 09/24/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)

1- File Copy

Office Action Summary	Application No. 08/709,487	Applicant(s) Hultgren, III, et al
	Examiner Daniel G. Mariam	Group Art Unit 2721

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 7-19-99.

☒ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-33 is/are pending in the application.

Of the above claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) 1-33 is/are rejected.

☐ Claim(s) ______ is/are objected to.

☐ Claim(s) ______ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on ______ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received: ______.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Interview Summary, PTO-413

☐ Notice of Informal Patent Application, PTO-152

☐ Other ______

Office Action Summary

U. S. Patent and Trademark Office
PTO-326 (Rev. 9-97)

*U.S. GPO: 1997-433-221/62717

Part of Paper No. 15

Response to Amendment

1. Applicant's arguments with respect to claims 1-33 have been considered but are moot in view of the new ground(s) of rejection. Although the above identified Application is not in condition for allowance, the Examiner thanks the Applicant for his effort and for the numerous informal telephone interviews to seek an early disposal of the case.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. While claims 1, 9, 16 and 24 recite the limitation "second data for describing device dependent spatial information content of the image", the specification says: "second data for describing a device dependent transformation of spatial information content of the image" (page 3, lines 11-13). Hence, it would not enable an ordinary artisan to make and/or use the invention.

4. Since claims 2-8, 10-15, 17-23 and 25-33 depend directly or indirectly on claims 1, 9, 16 and 24, they are also rejected for the same reason set forth above for claims 1, 9, 16 and 24.

Claims 9, 16 and 24 are rejected under 35 U.S.C. 112, first paragraph, as containing

subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claims recite the limitation ". . through use of measured chromatic stimuli and device response characteristic functions. . , spatial stimuli. . ", this limitations are not supported by the specification. Only a cursory is mention of these units is made on page 3, line 8. It is not understood exactly the advantage of using this unit within the scope of the invention nor whether applicant is making use of a known off-the-shelf unit.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

6. Claims 1, 9, 16 and 24 rejected under 35 U.S.C. 102(e) as being anticipated by Stokes (5,881,209).

With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent

spatial, i.e, XYZ space, coordinates, location, etc.., information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43).

With regard to claim 9, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc.., information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure 1 clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 51).

Claim 16 is rejected the same as claim 9 except claim 16 is an apparatus claim. Thus, argument similar to that presented above for claim 9 is applicable to claim 16.

With regard to claim 24, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stokes (5,881,209) in view of Laumeyer, et al (5,572,632).

With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc. . , information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43). It is extremely well known that images not only contain color information but also spatial information. Stokes discloses various ways of describing the spatial information as set forth above. Stokes does not explicitly use the language "spatial information". However, this feature is clearly taught by Laumeyer, et al (col. 10, line 56 - col. 11, line 49).

Stokes and Laumeyer, et al are combinable because they are from a similar problem solving area, i.e., generating device profiles (col. 15, lines 7-29), for example. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Laumeyer, et al with Stokes. The motivation for doing so is for no other reason than to replace the various terminology used by Stokes, such as, XYZ space, location, coordinates

with the specific language of spatial information (see entire document). Therefore, it would have been obvious to combine Laumeyer, et al with Stokes to obtain the invention as specified in claim 1.

With regard to claim 9, Stokes discloses generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc.., information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure 1 clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 51).

Claim 16 is rejected the same as claim 9 except claim 16 is an apparatus claim. Thus, argument similar to that presented above for claim 9 is applicable to claim 16.

With regard to claim 24, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

9. Claims 1-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stokes (5,881,209) in view of Cottrell, et al (5,694,484).

With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc.., information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43). It is extremely well known that images not only contain color information but also spatial information. Stokes discloses various ways of describing the spatial information as set forth above. Stokes, however, does not explicitly use the language "spatial information". However, this feature is clearly taught by Cottrell, et al (col. 17, line 55 - col. 19, line 13), for example.

Stokes and Cottrell, et al are combinable because they are from a similar problem solving area, i.e., generating device profiles (abstract, #21A, Fig. 2), for example. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Cottrell, et al with Stokes. The motivation for doing so is for no other reason than to replace the various terminology used by Stokes, such as, XYZ space, location, coordinates with the specific language of spatial information (col. 34, line 32). Therefore, it would have been obvious to combine Cottrell, et al with Stokes to obtain the invention as specified in claim 1.

With regard to claim 2, Cottrell further discloses the second data is represented by a first characteristic function describing added noise characteristic (abstract; column 18, lines 3-52).

With regard to claims 3, 7 and 8, as best understood, claims 1 and 2 encompass the limitations of these claims and thus they are met by the prior art. As to Weiner Noise Spectra/Spectrum, applicants' attention is invited to (col. 18, line 53 - col. 19, line 2 of Cottrell, et al).

With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

With regard to claim 9, Stokes discloses generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc.., information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure 1 clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 51).

With regard to claim 33, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 16 is rejected the same as claim 9 except claim 16 is an apparatus claim. Thus, argument similar to that presented above for claim 9 is applicable to claim 16.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

With regard to claim 24, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Claim 32 is rejected the same as claim 9. Thus, argument similar to that presented above for claim 9 is applicable to claim 32.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CAR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CAR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

September 17, 1999

Phuoc Tran
PHUOC TRAN
PRIMARY EXAMINER

Polaroid

Law & Patent Division

Polaroid Corporation
784 Memorial Drive
Cambridge, MA 02139
781 386 6474
781 386 6435 / Fax
deckerr@polaroid.com

FACSIMILE TRANSMISSION

BOX AF

To:	Examiner Daniel G. Mariam United States Patent and Trademark Office Group Art Unit: 2721		
Fax No.:	703-308-5397	**Tel No.:**	703-305-4010
From:	Robert J. Decker		
Date:	December 23, 1999		
Re:	Notice of Appeal and Amendment After Final for Patent Application Serial No. 08/709,487 Filed 9/6/96 by Hultgren et al. Title: Device Profiles for Use in a Digital Image Processing System Attorney Docket No. 8166/RJD		

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I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office on December 23, 1999.

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

Dear Examiner Mariam:

Thank you for your Final Office Action dated September 24, 1999. As per my voice-mail message of December 23, 1999, I have filed an Amendment (§1.116) and Notice of Appeal. In accordance with your §112(1) rejections we have amended the claims to conform with your suggestion.

With regard to the §§102 and 103 issues, perhaps we could have an Examiners Interview. I would be very happy to set up a conference telephone call having the following coinventors and Image Science Practitioners present:

OFFICIAL

Dr. Bror Hultgren
Dr. Jay Thornton
Dr. Dick Cottrell
Dr. Julian Bullitt
Dr. Orlando Lopez

Thank you for your assistance in this matter.

Best regards,

Rob Decker

<u>This message is intended only for the use of the addressee and may contain information that is privileged and confidential.</u> If you are not the intended recipient, you are hereby notified that any dissemination of this communication is strictly prohibited. If you receive this communication in error, please notify us immediately and return the original message to the above address via the US Postal Service. Thank you.

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#16

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TC 2700 MAIL ROOM

Serial No.: 08/709,487
Filed: September 6, 1996
By: Hultgren et al.
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Art Unit: 2721
Examiner: D. Mariam

BOX AF
Assistant Commissioner for Patents
Washington, D.C. 20231

[redacted]
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Date: December 24, 1999

Robert J. Decker
Attorney for the Applicant Under 37 C.R.R. § 1.34(a)
Registration No. 44,056

NOTICE OF APPEAL FROM THE PRIMARY EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES (37 C.F.R. § 1.191)

Sir:

Applicants hereby appeal to the Board from the decision of the Examiner mailed September 24, 1999, finally rejecting claims 1 to 33.

The fee for this Notice of Appeals pursuant to 37 C.F.R. § 1.17(b) is $300.00, which can be charged to Deposit Account No. 16-2195.

An Amendment (dated December 23, 1999) pursuant to 37 C.F.R. § 1.116 is being filed concurrently herewith.

Please charge any additional fee due, or credit any overpayment, to Deposit Account No. 16-2195.

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Respectfully submitted,

Robert J. Decker
Attorney Acting Under 37 C.F.R. 1.34(a)
Registration No. 44,056

Tel: 781-386-6474
Fax: 781-386-6435

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Docket No. C-8166/RJD

PATENT

#17/D KD 1-15-00 (AE)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

DEC 30 1999 JC25 PATENT & TRADEMARK OFFICE

Serial No.: 08/709,487
Filed: September 6, 1996
By: Hultgren et al.
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Date: December 24, 1999

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

AMENDMENT UNDER 37 C.F.R § 1.116

Sir:

In response to the Final Office Action dated September 24, 1999, having a three (3) month shortened statutory period set to expire December 24, 1999, please amend the above captioned application as follows:

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IN THE CLAIMS:

Please amend claims 1, 9, 16, 24, and 33 as follows:

1. (THRICE AMENDED) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.

10 ~~9~~. (THRICE AMENDED) A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;

generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and

combining said first and second data into the device profile.

18 ~~16~~. (THRICE AMENDED) A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space through use of chromatic response characteristic functions; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device independent color space through the use of spatial characteristic functions describing image spatial transform characteristics in said device independent color space.

26 ~~24~~. (THRICE AMENDED) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

11 ~~33~~. (ONCE AMENDED) The method of claim ~~9~~ 10 wherein, for said device:

[the first] said second data is represented by a [color] first characteristic function describing added noise characteristics[;] and [the second data is represented by a spatial] a second characteristic function describing image signal transform characteristics.

REMARKS

I. STATUS OF THE CLAIMS

Claims 1-33 are pending in the application.

Claims 1, 9, 16, and 24 are independent claims.

Claims 1-33 stand rejected under 35 U.S.C. § 112(1).

Claims 1, 9, 16, and 24 stand rejected under 35 U.S.C. § 102.

Claims 1-31 stand rejected under 35 U.S.C. § 103.

II. AMENDMENTS

As discussed in greater detail below, the claims have been amended to clarify the invention in response to the Examiner's rejection under 35 U.S.C. § 112, first paragraph,.

It is believed that the amendments do not involve the addition of any new matter.

III. NOTICE OF APPEAL

Please note that a Notice of Appeal is being filed concurrently herewith under 37 C.F.R. § 1.191.

IV. INTRODUCTION

As an introduction to discussing the Examiner's rejections to the pending patent application, the Applicants would like to propose what basic knowledge could be assumed of a practitioner of image science (i.e. one of ordinary skill in the arts which encompass the field of the Applicants' present invention). Such practitioner would at a minimum be familiar with

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color science as taught in volumes such as Hunt[1] and Stiles and Wyszecki[2] for understanding the concepts and formalism of describing color and tone reproduction. Further, the practitioner of image science would be familiar with the concepts of spatial micro image structure and processing as taught in Dainty and Shaw[3] and Castleman[4].

Based on these sources, the Applicants would like to respectfully clarify apparent confusions in the Examiner's response both in the use of spatial and color space coordinate systems and in the types of transformations being applied.

Part of the confusion arises because the same nomenclature is often used in the image science field to mean different things in different situations — e.g. the Cartesian spatial coordinates may be referred to as xyz while color space coordinates are often described in terms of the tristimulus coordinates XYZ. While the nomenclature is often not unique, the practitioner of ordinary skill in the arts of image science understands the meaning WITHIN the CONTEXT of the usage of the terminology.

A complete description of an image must describe the color at each point in the image. For a two-dimensional image this means that the color must be specified at each position in the image, given by two "spatial coordinates" x and y. Color images are usually described as being a function defining three color values for each independent spatial location. It is this formulation that is applied in the specification of the Applicants' present invention (see page 5, lines 18-20). Some common color descriptions are device dependent like {rgb} for a specific camera; others are device independent color spaces either like the uniform color space {L*a*b*} or the tristimulus coordinates {XYZ}.

The concept of a transformation is defined as a physical "act of changing markedly the form or appearance" of an entity, or as a mathematical "mapping of one space onto another or into itself"[5]. The term space is used here in the mathematical sense, i.e., a space is a set of n-tuples where n is the dimensionality of the space. A transformation, in the sense that it is used in the specification and claims of the Applicants' pending Application, is a prescription for establishing a connection, or mapping, between a group of points in one

[1] Hunt, R.W. G., *The Reproduction of Color*, 4th ed., Fountain Press, London (1975).
[2] Stiles, W. S. & Wyszecki, G. *Color Science*, 2nd ed., Wiley, New York (1982).
[3] Dainty J. C., & Shaw, R., *Image Science*, Academic Press, London (1974).
[4] Castleman K.R., *Digital Image Processing*, Prentice-Hall, Englewood Cliffs (1979).

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space to another group of points in the same or a different space. The meaning of the term "transformation" is evident to the practitioner of ordinary skill in terms of the context. In the context of this introduction, the term "transformation" is summarized as follows:

- Transformations applied to the color space coordinate — e.g. transforming the device dependent video {rgb} triplet to a device independent tristimulus triplet {XYZ}. Such transformations are associated with color management systems and color management (cf. Laumeyer,[6] Column 8, lines 11-32).
- Point transformations applied at each spatial location, independent of neighboring spatial locations to change the color of the image at that point. Examples are contrast and brightness adjustments that affect the color description at that point in the image within a fixed color space and 'gamma' correction for CRT display (cf. Hunt, p. 393-396).
- Transformations applied to the spatial (in the sense of real space such as distance in an image) coordinate systems — e.g. the process of digital zoom will transform the image spatial coordinate {xy} to a new coordinate {x'y'} (cf. Cottrell,[7] column 21, lines 48-65).
- Transformations applied to the image information represented in a spatial coordinate system (e.g. Cartesian) to convert that into a complex coordinate representation in terms of spatial frequency and phase — these transformations are known as Fourier Transforms (see Applicants' specification at page 5, line 18 to page 6, line 8).
- Convolution is a transformation that is applied over a neighborhood of spatial locations, to change the value of the image at one point based on its value and the values at the surrounding positions — e.g. the effect of blurring could be modeled by convolution (see Applicants' specification at page 6, eq. 5).

A practitioner of ordinary skill in the art of image science will be familiar with all of these types of transformations and will recognize that the initial two, as listed above, are concerned with Color Management. The purpose of such Color Management Systems is discussed in the exposition of prior art for this pending Application and is the subject matter

[5] *The American Heritage Dictionary*, Houghton Mifflin, Boston (1976).
[6] Laumeyer, R. A., Laurel C. J., U.S. Patent No. 5,572,632 (1996) [cited in 9/24/99 Final Office Action].

of the patents of Stokes[8] and Laumeyer et al. A practitioner of the art of image science will recognize that the latter three, as listed above, are concerned with the Spatial Management of the imaging process. The concept of Spatial Management is proposed as a corresponding technique to Color Management in the Cottrell '484 patent. In general, as an indication of the extent to which the invention is not evident to one skilled in the art, we reference a technical paper by MacDonald[9], entitled *Framework for an Image Sharpness Management System*. The author Lindsay MacDonald is associated with The Color and Imaging Institute of the University of Darby. This Institute is advertising for a two year Post Doctoral Fellow to perform research work relating to the development of a computational framework for image sharpness management. The work is being funded by an American computer company with close ties to the development of ColorSync. Whereas the Applicants' present invention addresses a system and method for furnishing the data structures required for such a Spatial Management system, i.e., to apply a device independent paradigm to spatial processing in a digital image processing system (See Applicants' specification, page 2, lines 25-28).

V. CLAIMS 1-33 ENABLE ONE SKILLED IN THE ART TO MAKE OR USE THE INVENTION WITHIN THE MEANING OF 35 U.S.C. § 112, ¶ 1, IN VIEW OF THE AMENDMENTS TO THE CLAIMS.

A. Base Claims 1, 9, 16, and 24, and Respective Dependent Claims

Claims 1-33 stand rejected under 35 U.S.C. § 112, first paragraph, as being non-enabling for failing to describe the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In particular, the Office Action states:

> Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. While claims 1, 9, 16 and 24 recite the limitation "second data for describing device dependent spatial information content of the image", the specification says: "second data for describing a device dependent

[7] Cottrell F. R., Hultgren B. O., U.S. Patent No. 5,694,484 (1997) [cited in 9/24/99 Final Office Action].
[8] Stokes, M., U.S. Patent No. 5,881,209 (1999) [cited in 9/24/99 Final Office Action].
[9] Macdonald, L. *Framework for an Image Sharpness Management System*, Proceedings of The Seventh Color Imaging Conference, 1999.

> ***transformation of*** spatial information content of the image" (page 3, lines 11 - 13). Hence, it would not enable an ordinary artisan to make and/or use the invention (emphasis provided).

(See Office Action, para. 3, page 2)

Applicants have amended the claims to particularly point out and distinctly claim the Applicants' invention. In response to the Examiner's rejection, base claims 1, 9, 16, and 24 have been amended by reinserting the phrase "transformation of" as originally filed.

B. Base Claims 9, 16, And 24, And Respective Dependent Claims

Claims 9-31 and 33 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification. In particular, the Office Action states:

> Claims 9, 16, 24 are rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claims recite the limitation ". . through use of measured chromatic stimuli and device response characteristic functions. . , spatial stimuli. . ", this limitations are not supported by the specification. Only a cursory is mention of these units is made on page 3, line 8. It is not understood exactly the advantage of using this unit within the scope of the invention nor whether applicant is making use of a known off-the-shelf unit. Claim 2, line 2, it is not clear what is meant by "contact section rounded section".

(See Office Action, para. 4, pages 2-3)

Applicants respectfully traverse the rejection of the claims under 35 U.S.C. § 112 (1) and assert that according to one skilled in the art, the claims as recited in the Applicants' pending application contain subject matter which was indeed described in the specification. For example, in base claims 9 and 24, one skilled in the art would appreciate that a spatial stimulus is "something that incites" the system "to action" and is therefore synonymous to an input to the system (Dainty and Shaw, pp.204-206, Section 6.2). Referring to page 6, lines 17-19 of the Applicants' specification, it states that "If the input image [stimulus] is an uniform image $I(x,y) = I_0$, Fourier analysis of the output image [response] will yield the Wiener Noise Power Spectrum $\mathcal{N}(u,v)$ which is the characteristic function for the imaging

device". Thus, as one skilled in the art would appreciate, that the use of the terms "stimuli" and "response" are described in the specification. Therefore, the specification is complete, in light of the claimed subject matter, to those of ordinary skill in the art.

Please note that "spatial stimuli" and "device response" was not specifically recited in base claim 16, and therefore this particular aspect of the Office Action would not be applicable.

Finally, it is unclear from the context how the term "unit(s)" is being applied on three occasions in the last three lines of para. 4, page 3 of the Office Action.

For the above reasons, Applicants respectfully request that the Examiner's rejection of claims 1-33 for lacking enablement/description under 35 U.S.C. § 112 (1) be withdrawn.

VI. CLAIMS 1, 9, 16, AND 24 ARE NOT ANTICIPATED UNDER 35 U.S.C. § 102 (e) BY STOKES BECAUSE THE PRIOR ART RELIED ON BY THE EXAMINER FAILS TO DISCLOSE THE APPLICANTS' INVENTION.

Claims 1, 9, 16, and 24 were rejected under 35 U.S.C. § 102(e) as being anticipated by Stokes U.S. Patent No. 5,881,209. Applicants respectfully traverse the rejection of amended claims 1, 9, 16, and 24 as being anticipated by Stokes because Stokes fails to disclose the Applicants' present invention as recited as follows:

a) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 1 which calls for:

> ...second data for describing a device dependent transformation of spatial information content of the image in said device independent color space;

b) a method intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 9 which calls for:

> ...generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions;

c) an image processing system for capturing, transforming, or rendering an image, as recited in amended base claim 16 which calls for:

> ...means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device

independent color space through the use of spatial characteristic functions describing image spatial transform characteristics in said device independent color space;
and/or

d) a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising

data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

In particular, the Office Action states with regards Stokes:

> With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:
> first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e., XYZ space, coordinates, location, etc.., information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43) **[1]**.
> With regard to claim 9, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:
> generating first data for describing a device dependent transformation of color information **content of the** image to a device independent color space through use of measured chromatic **stimuli,** i.e., for **example,** XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, i.e., XYZ space, coordinates, location, etc.., information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the **mouse** "20", shown in Figure I clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 51). **[2]**

(See Office Action, para 6. pages 3-4, emphasis provided).

1: Stokes discloses, claim 1, creating a color printer profile beginning with a target having a plurality of color samples thereon and printing images on said printer using said profile. In the specification, (Stokes, col. 5, lines 10-36), Stokes describes how a CMM first converts the color data from the device dependent color space within the source color devices to a device independent color space such as CIE XYZ space. Any ordinary artisan would

know that the XYZ space is a color space as taught by Schreiber[10] (Schreiber, p. 177). In contrast, spatial information content of the image would not be expressed using XYZ space as the independent variable. For example , it would not be possible to perform the characterization of spatial content described in Fig. 12, p. 245 of "Dainty and Shaw" in the color XYZ space. To avoid confusion, it is useful to refer to the coordinate system that describes "real space" (such as distance in an image – in inches, or angular variation) as s1, s2, s3 instead of lower case "x, y, z". In order to avoid confusion with the XYZ color space, the abscissa in the edge spread function and the line spread function in Fig. 12, p. 245 of "Dainty and Shaw" should be labeled s1. The ordinate could, in some cases, be related to the color space units. Thus, contrary to the Office Action, Stokes does not in any part of the referenced patent disclose or refer to any such determination of spatial content and therefore does not anticipate the base claims of the Applicants present invention.

2: See note 1. Also, as one skilled in the art would appreciate, and contrary to the Office Action, the mouse, shown in Figure 1 of Stokes, would not be able to "clearly generate spatial stimuli and device response characteristic functions" using the method described by Fig. 12, p. 245 of "Dainty and Shaw". Rather, as one skilled in the art would appreciate, the measurement of micro-image properties such as MTF and the Weiner spectrum of noise requires some form of a microdensitometer for analysis (rather than a mouse as suggested by the Office Action) of the developed image.

In summary, neither Stokes nor the cited prior art discloses the system and method of the Applicants' present invention as cited in the base claims above.

Accordingly, as anticipation under 35 U.S.C. § 102 requires that each and every element of the claim be disclosed in the prior art reference, it is respectfully submitted that neither Stokes nor the applied prior art anticipate the base claims 1, 9, 16, and 24. Claims 2-8, 10-15, 17-23, and 25-33 are dependent from the base claims and includes all limitations of the base claims.

In view of difference between claims 1-33 and Stokes, Applicants respectfully urge that the rejections of claims 1-33 be withdrawn.

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[10] Schreiber, W. F., *Fundamentals of Electronic Imaging Systems*, 2nd ed., Springer-Verlag, Germany (1991).

VII. AMENDED CLAIMS 1, 9, 16, AND 24 ARE PATENTABLE UNDER 35 U.S.C. § 103 OVER STOKES 5,881,209 IN VIEW OF LAUMEYER BECAUSE THE APPLIED PRIOR ART TAKEN AS A WHOLE FAILS TO SUGGEST THE APPLICANTS' INVENTION

Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. § 103 as being unpatentable over Stokes U.S. Patent 5,881,209 in view of Laumeyer et al. U.S. Patent 5,572,632 (hereinafter "Laumeyer").

Applicants respectfully submit that claims 1, 9, 16, and 24 would not have been obvious under 35 U.S.C. § 103 over Stokes in view of Laumeyer because the applied prior art fails to teach or suggest the Applicants' present invention as recited as follows:

a) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 1 which calls for:

> ...second data for describing <u>a device dependent transformation of spatial information content of the image in said device independent color space</u>;

b) a method intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 9 which calls for:

> ...generating second data for describing <u>a device dependent transformation of spatial information content of the image in said device independent color space</u> through use of spatial stimuli and device response characteristic functions;

c) an image processing system for capturing, transforming, or rendering an image, as recited in amended base claim 16 which calls for:

> ...means for utilizing second data of the device profile for describing <u>a device dependent transformation of spatial information content of the image in said device independent color space</u> through the use of spatial characteristic functions describing image spatial transform characteristics in said device independent color space;
>
> and/or

d) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 24 which calls for:

> ...said device profile comprising data for describing <u>a device dependent transformation of spatial information content of the image in a device independent color space</u>, wherein through use of spatial stimuli and device response for said device, said data is represented by characteristic functions.

In particular, the Final Office Action states with regards to Stokes and Laumeyer:

> With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:
>
> first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e., XYZ space, coordinates, location, etc.. , information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43). It is extremely well known that images not only contain color information but also spatial information. Stokes discloses various ways of describing the spatial information as set forth above. Stokes does not explicitly use the language "spatial information". However, this feature is clearly taught by Laumeyer, et al (col. 10, line 56 - col. 11, line 49) **[3]**.
>
> Stokes and Laumeyer, et al are combinable because they are from a similar problem solving area, i.e., generating device profiles (col. 15, lines 7-29), for example. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Laumeyer, et al with Stokes. The motivation for doing so is for no other reason than to replace the various terminology used by Stokes, such as, XYZ space, location, coordinates with the specific language of spatial information (see entire document). Therefore, it would have been obvious to combine Laumeyer, et al with Stokes to obtain the invention as specified in claim 1 **[4]**.
>
> With regard to claim 9, Stokes discloses generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, Le, XYZ space, coordinates, location, etc.. , information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure I clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 5 1) **[5]**.
>
> Claim 16 is rejected the same as claim 9 except claim 16 is an apparatus claim. Thus, argument similar to that presented above for claim 9 is applicable to claim 16.
>
> With regard to claim 24, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

(See Office Action, para 8, pages 5-6).

3: As described by Laumeyer, the L*a*b* color space is used as the device independent color space (e.g., the L*a*b* color space is described in Schreiber, p.182). As one skilled in

the art would appreciate, spatial information content of the image would not be expressed using L*a*b* space as the independent variable. For example, it would not be possible to perform the characterization of spatial content described in Fig. 12, p. 245 of "Dainty and Shaw" using only the color L*a*b* space. Contrary to the Office Action, when Laumeyer refers to a "spatial location" in L*a*b* space, any ordinarily skilled artisan would understand that Laumeyer refers to a triplet (L*,a*,b*) that describes a color value (i.e., "spatial location" refers to location in a space in the mathematical sense). Contrary to the Office Action, Stokes does <u>not</u> in any part teach or suggest any such determination of spatial content. Similarly, contrary to the Office Action, Laumeyer <u>only</u> refers to <u>color</u> spaces.

4: See note 3.

5: See notes 1 and 2.

In summary, the Examiner's reliance on Laumeyer's image data processing system does not supply the deficiencies of the Stokes disclosure vis-à-vis Applicants' base claims 1, 9, 16, and 24. Accordingly, neither Stokes, nor Laumeyer taken alone, or in combination, would have suggested Applicants' invention of base claims 1, 9, 16, and 24. Claims 2-8, 32, 10-15, 33, 17-23, and 25-31 are dependent from claims 1, 9, 16, and 24, respectively, and include all the limitations of the latter claims. A dependent claim contains all the limitations of the independent claim upon which it depends and is non-obvious under Federal Circuit guidelines if the independent claim upon which it depends is allowable.

VIII. AMENDED CLAIMS 1-33 ARE PATENTABLE UNDER 35 U.S.C. § 103 OVER STOKES 5,881,209 IN VIEW OF COTTRELL ET AL. BECAUSE THE APPLIED PRIOR ART TAKEN AS A WHOLE FAILS TO SUGGEST THE APPLICANTS' INVENTION

Claims 1-33 are rejected under 35 U.S.C. § 103 as being unpatentable over Stokes U.S. Patent 5,881,209 in view of Cottrell et al. U.S. Patent 5,694,484 (hereinafter "Cottrell").

Applicants respectfully submit that base claims 1, 9, 16, and 24 would not have been obvious under 35 U.S.C. § 103 over Stokes in view of Cottrell because the applied prior art fails to teach or suggest the Applicants' image reproduction system/method/profile for

capturing, transforming, or rendering an image as recited in base claims 1, 9, 16, and 24, respectively (see Section VII above for recitation of claims in part).

In particular, the Office Action states with regards to Stokes and Cottrell:

> With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:
>
> first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e., XYZ space, coordinates, location, etc.., information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43). It is extremely well known that images not only contain color information but also spatial information. Stokes discloses various ways of describing the spatial information as set forth above. Stokes, however, does not explicitly use the language "spatial information". However, this feature is clearly taught by Cottrell, et al (col. 17, line 55 - col. 19, line 13), for example.
>
> Stokes and Cottrell, et al are combinable because they are from a similar problem solving area, i.e., generating device profiles (abstract, #21A, Fig. 2), for example. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Cottrell, et al with Stokes. The motivation for doing so is for no other reason than to replace the various terminology used by Stokes, such as, XYZ space, location, coordinates with the specific language of spatial information col. 34, line 32). Therefore, it would have been obvious to combine Cottrell, et al with Stokes to obtain the invention as specified in claim 1 **[6]**.
>
> With regard to claim 2, Cottrell further discloses the second data is represented by a first characteristic function describing added noise characteristic (abstract; column 18, lines 3-52).
>
> With regard to claims 3, 7 and 8, as best understood, claims I and 2 encompass the limitations of these claims and thus they are met by the prior art. As to Weiner Noise Spectra/Spectrum, applicants' attention is invited to (col. 18, line 53 - col. 19, line 2 of Cottrell, et al) **[7]**,
>
> With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48) **[8]**.
>
> Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.
>
> With regard to claim 9, Stokes discloses generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device

dependent spatial, Le, XYZ space, coordinates, location, etc.., information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure I clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 5 1) [9].

6: Stokes teaches how to "convert the color data from the device dependent color space within the source devices to device independent color space". But, as detailed above in note 1 (Section VI), Stokes does not in any part of the referenced patent describe or refer to any such determination of spatial content and therefore does not teach or suggest the Applicants' claimed invention. Cottrell teaches how to use image data from an image data source, and how to perform at least one image processing operation to generate psychovisually optimized processed image data. Some of that image data could be the Modulation Transfer function and/or the Wiener Power Spectrum, which are used to describe the spatial characteristics. These measures are well known to those schooled in the art (see, for example, "Dainty and Shaw", Chapters 7 & 8). However, Cottrell does not describe how the information is represented. If the spatial characteristics of the image are represented, as has been done historically, in a device dependent model, spatial characteristics of digital imaging devices will be modified in the context of the device dependent model. A primary object of the Applicants' present invention, as specifically stated on page 2, lines 25-28, is to apply a device independent paradigm to spatial processing in a digital image processing system. An advantage of the present invention is that it enhances processing versatility. Since Cottrell does not describe the representation and data structure for the spatial information and Stokes does not teach or suggest any such determination of spatial content, it would not be possible to combine the two references to arrive at the Applicant's claimed invention.

7: See note 6.

8: One skilled in the art would appreciate that any input device produces an image that assigns a value of the color variables (r,g,b or Yuv) to a spatial location in the image (e.g., a location in a scene being captured would be represented in the captured image by a color triplet (r, g, b) at the corresponding spatial location (s1, s2, s3)). Cottrell teaches how to

optimally process such an image. However, Cottrell does not describe how the information is represented. If the spatial characteristics of the image are represented, as has been done historically, in a device dependent model, spatial characteristics of digital imaging devices will be modified in the context of the device dependent model. A primary object of Applicants' present invention, as stated on page 2, lines 25-28, is to apply a device independent paradigm to spatial processing in a digital image processing system. An advantage of the present invention is that it will enhance processing versatility.

9: See notes 1 and 2.

In summary, the Examiner's reliance on Cottrell's image processing system does not supply the deficiencies of the Stokes disclosure vis-à-vis Applicants' base claims 1, 9, 16, and 24. Accordingly, neither Stokes, nor Cottrell taken alone, or in combination, would have suggested Applicants' invention of base claims 1, 9, 16, and 24. Claims 2-8, 32, 10-15, 33, 17-23, and 25-31 are dependent from claims 1, 9, 16, and 24, respectively, and include all the limitations of the latter claims. A dependent claim contains all the limitations of the independent claim upon which it depends and is non-obvious under Federal Circuit guidelines if the independent claim upon which it depends is allowable.

IX. CONCLUSION

Please charge any excess fees due and credit any overpayment to Charge Account No. 16-2195.

It should be noted that the above arguments are directed towards certain distinctions between the claims and the prior art cited which the Applicants believe make the pending claims patentable. However, the differences between the pending claims and the prior art cited is not necessarily limited to those distinctions.

For the foregoing reasons, Applicants respectfully urge that the instant amendment be entered, and submit that amended claims 1-33 are in condition for allowance, an indication of which is solicited.

08/709,487

THE REPRODUCTION OF COLOUR IN PHOTOGRAPHY, PRINTING & TELEVISION

R. W. G. HUNT
D.Sc. · D.I.C. · A.R.C.S. · F.R.P.S. · F.R.S.A. · M.R.T.S. · F.B.K.S.T.S.

Visiting Professor of Physiological Optics, The City University, London
Formerly Assistant Director of Research, Kodak Limited, Harrow

With a Foreword by

PROFESSOR W. D. WRIGHT · D.Sc. · A.R.C.S. · D.I.C.
Formerly Head of the Applied Optics Section, Imperial College of Science & Technology, South Kensington, London

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Foreword

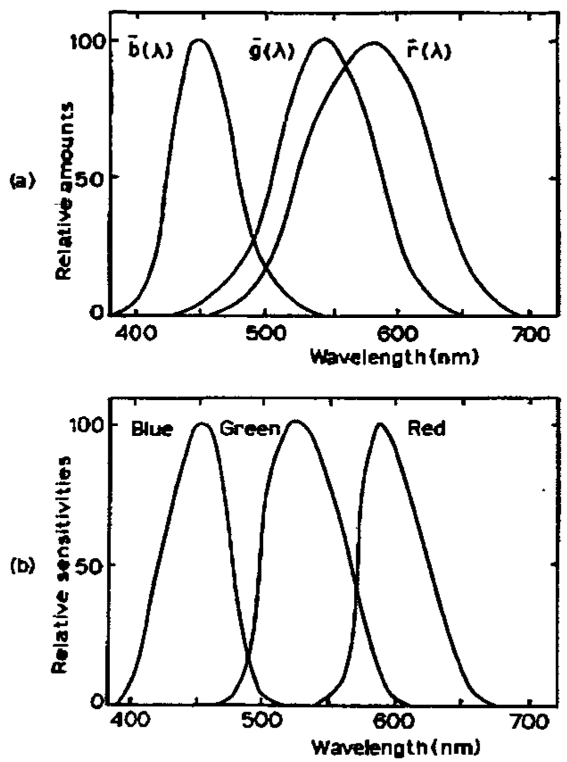
The development of colour photography, colour television, and colour printing demands a very wide and deep understanding of the facts of colour mixture and colour perception. These methods of colour reproduction all have many interesting technical problems to solve, while physiologically the processes in the eye and the brain exercise their own subtle influences on the visual appearance of a colour reproduction. Moreover, the final assessment of a colour picture calls for aesthetic as well as scientific appraisal.

Evidently, then, a book on the reproduction of colour requires a broad outlook on the part of the author, and Dr. Hunt, with his understanding of the basic theory, his experience of commercial production, and his own contributions to fundamental research, is very well qualified to give a balanced and comprehensive account of the subject. This he has undoubtedly succeeded in doing, and in view of his original work on colour adaptation and the visual response, his comments on the subjective aspects of colour reproduction will command particular respect. However much we may regret that the requirements of a colour reproduction cannot be expressed in precise colorimetric terms, we have to recognize that engineering concepts alone are not enough.

The publication of this book will give much pleasure to Dr. Hunt's colleagues and friends, and especially to those who have had the privilege of listening to him present a paper or deliver a lecture, for the orderly presentation of his material and the clarity of his thought on such occasions deserve, and will now reach, a much wider audience. For myself, I regard it as an honour to have been invited to write this Foreword and by undertaking such an agreeable task to continue my association with Dr. Hunt, which dates from the time when he was a student at the Imperial College, and has included our co-operation in a series of courses on the Fundamentals of Colour Reproduction.

W. D. WRIGHT

ns is that the resulting red and green curves usually overlap less than is the r typical all-positive curves; this can be seen from Fig. 19.9 where the est set of all-positive colour-matching functions (Yule, 1973) are com- to a set of sensitivity curves typical of those used in cameras and imating the positive parts of colour-matching functions of the type shown 19.7. This greater wavelength separation of the positive parts means that n be produced more efficiently in cameras using dichroic beam-splitting s (see Chapter 20). This advantage is gained at the price of departing ably from correct colorimetric analysis of the scene, but Sproson has that if positive-part sensitivity curves are used with matrixing the etric errors likely to occur in practice can be reduced to quite small values,



9.9 (a) The narrowest possible set of colour-matching functions. (b) Sensitivities l of those used in television cameras and approximating the positive parts of the colour-matching functions of Fig. 19.7.

if the constants in the matrix are worked out empirically to minimize the errors for typical scene colours (Sproson, 1966). This is shown as the fifth alternative in Fig. 19.8; it is also widely used (see Section 20.10).

The neglect of the negative portions of the matching functions results, in the fourth alternative of Fig. 19.8, in the luminance signal being based, in effect, on a three-humped spectral sensitivity curve instead of on the single-humped $\bar{y}(\lambda)$ curve which is required to give true luminance; the result is that the luminances displayed on both monochrome and colour receivers suffer from errors, and these can be quite large, notably in the case of blues which are lightened appreciably. The matrixing used in the fifth alternative of Fig. 19.8 can also result in these luminance errors being greatly reduced.

The fifth alternative can be operated by carrying out the matrixing either at the camera or at the receiver. European practice is to do it at the camera, and with cameras using Plumbicon tubes, with their nearly linear response, it is theoretically correct to matrix the actual signals produced by the tubes. In the U.S.A., if matrixing is carried out, it is often done at the receiver (or monitor); since the signals at this stage are no longer linearly related to the optical image (for reasons to be described in the next section), it is not theoretically correct to matrix them at that stage. However, calculations and practical tests have shown that the resulting errors are not too large. An advantage of matrixing at the receiver is that, as new phosphors are brought out, the matrixing can be adjusted accordingly (DeMarsh, 1974).

19.13 Gamma correction

So far, a linear relation has been assumed between the electrical and corresponding optical signals at both the camera and the receiver. But the light output from receiver tubes is not linear: it is approximately proportional to the cube of the applied voltage. Thus if the logarithm of the resulting tube luminance is plotted against the logarithm of the applied voltage the slope of the line obtained (that is, the gamma) is about 3 (2.8±0.3 is the accepted index for colour receivers).

From the point of view of signal-to-noise ratio, a high gamma is desirable because the darker portions of the picture, where noise is most obvious, tend to be reproduced nearly black. But while a monochrome picture which has a gamma of about 3 might be tolerable, a colour picture will exhibit severe colour distortion.

Suppose E_R, E_G, E_B are intended to produce a colour R(R)+G(G)+B(B) on a linear display. If, instead, they are applied to a cube law display, the resulting colour is R^3(R)+G^3(G)+B^3(B). For example, if $R=1$, $G=\frac{1}{2}$, $B=\frac{1}{2}$ and unit quantities of (R), (G), and (B) result in a white (W), then the intended colour is equivalent to $\frac{1}{2}$(W)+$\frac{1}{2}$(R). But the displayed colour will be $R=1$, $G=\frac{1}{8}$, $B=\frac{1}{8}$, or $\frac{1}{8}$(W)+$\frac{7}{8}$(R). Hence the luminance has decreased, and the saturation has increased. A simple means of correcting for this is to pre-distort the signals E_R, E_G, E_B, at the transmitter to $E_R{}^{1/\gamma}$, $E_G{}^{1/\gamma}$, $E_B{}^{1/\gamma}$; the luminance signal is then

transmitted as $E_Y' = lE_R^{1/\gamma} + mE_G^{1/\gamma} + nE_B^{1/\gamma}$, and the colour-difference signals as $E_R^{1/\gamma} - E_Y'$ and $E_B^{1/\gamma} - E_Y'$.

At the receiver the corresponding green colour-difference signal $E_G^{1/\gamma} - E_Y'$ is obtained thus:

$$E_G^{1/\gamma} - E_Y' = -\frac{l}{m}(E_R^{1/\gamma} - E_Y') - \frac{n}{m}(E_B^{1/\gamma} - E_Y')$$

Then by adding E_Y' to all three colour-difference signals the voltages $E_R^{1/\gamma}$, $E_G^{1/\gamma}$, $E_B^{1/\gamma}$, are recovered, and can be applied to the appropriate tubes (with power law γ) to give the correct R, G, B.

This method gives distortionless large-area reproduction. But the luminance carried by E_Y' (which would be displayed by a monochrome receiver all over the picture, and by a colour receiver in fine detail) is $(E_Y')^\gamma$. The ratio of luminance carried by E_Y' to the true luminance is:

$$\frac{(E_Y')^\gamma}{E_Y} = \frac{(lE_R^{1/\gamma} + mE_G^{1/\gamma} + nE_B^{1/\gamma})^\gamma}{lE_R + mE_G + nE_B}$$

For the worst case (saturated blue) this ratio is:

$$\frac{n^\gamma E_B}{nE_B} = n^{\gamma - 1} = 0.11^{1.8} = 0.019$$

assuming values of 0.11 for n and 2.8 for γ which are fairly typical.

So in this case the luminance signal E_Y carries only 2% of the true luminance; hence small-area saturated colours are reproduced too dark. Also compatibility suffers, as a monochrome receiver will display too little luminance; however, in practice, the effect of the non-linearity of the cathode-ray tube characteristic on the dots produced by the chrominance signals increases the 2% quoted to about 5% (see Section 19.10). Thus monochrome errors are not too bad, and large area colour is correct. But as E_Y' does not carry all the luminance, the remainder must be carried by the sub-carrier modulation, and hence the constant luminance principle is not obeyed, with the result that the subjective effect of noise and interference is increased.

A further point is that, as the sub-carrier modulation is severely limited in bandwidth, definition will suffer because the luminance content of the sub-carrier will also be limited in bandwidth. But for white, $E_R = E_G = E_B$, and $\frac{(E_Y')^\gamma}{E_Y} = 1$, and for the more prevalent neutral shades the ratio will not be very much less than unity. Hence the above shortcomings are evident only for the higher saturations (see Fig. 22.4).

There are several alternative methods for gamma correction, but in general these involve additional complications at the receiver. For instance, if the luminance signal was composed *before* E_R, E_G, and E_B were predistorted and the signals transmitted were $E_R^{1/\gamma} - E_Y^{1/\gamma}$, $E_B^{1/\gamma} - E_Y^{1/\gamma}$, and $E_Y^{1/\gamma}$ then the above difficulties would not arise. But the recovery of the green signal is then much more complicated, requiring the signals first to be raised to the power γ, then mixed to

obtain E_G, then re-distorted to the power $1/\gamma$, before finally applying them to the tube.

So far, it has been assumed that the signals are pre-distorted by the full factor of $1/\gamma$. In practice, however, the gamma correction applied to the signals only amounts to raising them to the power of 1/2.2, whereas colour receivers usually have gammas of about 2.8 (±0.3). The result of this is that in the final display the gamma of the picture is increased over that of the original scene by a factor of 2.8/2.2, that is 1.273 times. This increase in displayed gamma is necessary (see Section 6.5) in order to overcome the reduction in apparent contrast caused by the dim surround conditions in which television is normally viewed (Bartleson and Breneman, 1967; Pitt and Winter, 1974); but, as can be seen from Fig. 19.10, increases in purity and shifts in dominant wavelength occur. The increases in purity can be beneficial in compensating for any losses of saturation caused by the

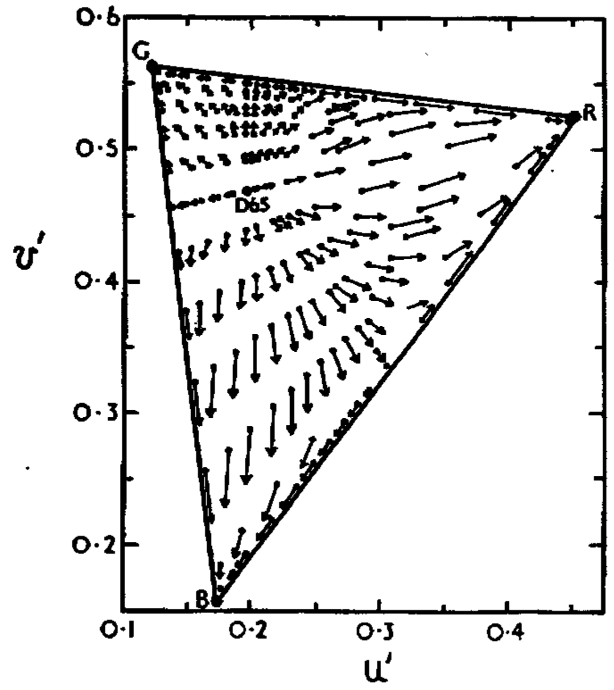


Fig. 19.10. Shifts in reproduced chromaticities resulting from altering the overall gamma of a television system from 1.0 to 1.273; a gamma of about 1.25 is required in order to offset the contrast lowering effect of the dim surround typical of normal television viewing conditions. (After Brown, 1971, Fig. 3.)

effects of the dim surround or by other factors; but the shifts in dominant wavelength can cause errors in hue. It has also been shown that, when the ambient lighting is increased to give a surround of luminance similar to the average picture-luminance, then the added flare light reduces the gamma from 1.25 to about 1.0 as required (Novick, 1969).

It has also been shown that to achieve a gamma of 1.25 in ambient lighting giving a dim surround whose luminance is about one-tenth (a typical value) of picture peak-white, the picture must be such that in the absence of ambient light it has a gamma of 1.5 (DeMarsh, 1972). This can be achieved by making adjustments to the black level of the camera so that its gamma is about 0.54 instead of 0.45 (1/2.2), or by making similar adjustments to the receiver so that its gamma is about 3.3 instead of 2.8, or by making partial adjustments to both.

When the transfer characteristic required from a gamma-reducing circuit is plotted as a voltage obtained against the voltage applied, the power-law functions involved call for ever-increasing amplification factors as the applied voltage is decreased to approach zero. Because these very high amplification factors are not realizable, the power functions are usually replaced by linear functions for low applied voltages, and the output voltages are then lower than they should be. This can cause undesirable increases in colour saturation, especially for red, orange, and yellow colours, which often have very low blue signals. The form of the linear approximation is often different from one camera to another, and this can cause undesirable changes in colour reproduction as cuts are made between cameras in a programme.

19.14 Noise reduction

Spurious signals in television give rise to random moving specks, generally called *noise*. Their harmful effects on picture quality can be reduced for stationary objects by averaging the signals over more than one frame, and this technique can result in marked improvements to the appearance of the pictures, even when some of the subject matter is moving (Sanders, 1980).

19.15 Higher definition television

The 525 and 625 line systems used for broadcast colour television were developed at a time when compatibility with monochrome receivers and economy of bandwidth were extremely important considerations. The advent of different forms of transmission, including satellite broadcasting, and both conventional and fibre-optic cable systems, means that signals requiring much broader bandwidth can be considered.

The Japan Broadcasting Corporation (NHK, Nippon Hoso Kyokai) and the BBC have proposed 1125 and 1501 line systems (Fink, 1980), as shown in Table 19.2. Neither of these systems would be compatible with existing systems, but proposals have been made for a 1249 line system (as also shown in Table

19.2), which would be compatible with existing 625 line systems. Compatibility could be achieved by transmitting the signal in two parts, one which would produce a 625 line picture on existing receivers, and the second which, together with the first, would produce a 1249 line picture on higher definition receivers; various ways have been proposed for combining the signals, one of which would add extra picture areas on either side of the compatible picture area to give an aspect ratio of about 8 to 3. As indicated in Table 19.2, a wider aspect ratio is usually considered a desirable feature of higher definition systems. An improved separation of the luminance and chrominance signals is also usually planned, either by using separate bandwidths, or by using more sophisticated methods of band sharing, or by using time sharing over line-scan periods by means of time compression devices. Displayed pictures of larger size are usually proposed, either by means of larger shadow-mask type tubes, or by projection devices, or by flat panel displays when technology permits. Broadcast transmission would have to be in the gigahertz (GHz) range of frequencies (usually 10 to 90 GHz, that is, 10 000 to 90 000 MHz).

TABLE 19.2

Parameters for proposed higher definition television

System	1125 line	1501 line	625 Compatible
Aspect ratio	5:3 or 2:1	8:3	4:3 or 8:3
Lines per picture	1125	1501	1249
Field frequency	60 Hz	60 Hz	50 Hz
Interlace ratio	2:1	2:1	2:1
Luminance bandwidth	20 MHz	50 MHz	10 MHz
Chrominance bandwidths	7.0 MHz 5.5 MHz	12.5 MHz 12.5 MHz	4 MHz 4 MHz

When space satellites are used for broadcasting, the form of the signals has to be revised to minimize power consumption, and proposals have been made to avoid luminance-chrominance band sharing by using time compression techniques over line-scan periods. For receivers to take full advantage of this, they would have to have the option of operating in this alternative mode.

19.16 Videoconferencing

A great deal of time and money is spent in attending business conferences, and the use of television is attractive as a more adequate substitute than is offered by telephone calls. The use of standard broadcast signals in this application is difficult because of their wide bandwidth, and systems using suitable compression of the information have been developed. In one such system, digital signals of only 2 megabits per second are used; but higher definition is obtained than would normally be expected from this rate, by storing the signals frame by

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Image Science

principles, analysis and evaluation of photographic-type imaging processes

J. C. DAINTY
Department of Physics,
Queen Elizabeth College,
University of London,
London, England

and

R. SHAW
Xerox Corporation,
Webster Research Center,
N.Y. 14580, U.S.A.

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Convolution has the effect of smoothing out the true transform, and this smoothing is more pronounced for small m in this computed example. Truncation errors have been investigated in more detail by Tatian[20].

The sampling interval δx is another variable of practical interest. The sampling interval used in both Figs. 6 and 7 gives a Nyquist frequency, u_{max}, equal to 1000 cycles/mm, but we may only be interested in the transform up to one or two hundred cycles/mm. Suppose for example that the transform is required up to 125 cycles/mm: by the sampling theorem the interval δx need only be 4 μm = 0·004 mm for u_{max} = 125 cycles/mm. In Fig. 8 the effect of increasing the sampling interval is shown, with intervals of:

(a) 0·5 μm; (b) 1 μm; (c) 2 μm; (d) 4 μm.

In each case the total range of the function has been kept the same, the number of sampling points thus decreasing as the sampling interval increases.

It is clear from Fig. 8 that if the sampling interval is selected in accordance with the sampling theorem (δx = 4 μm), there is a significant positive bias in the computed transform. This is the result of a phenomenon known as "aliasing", whereby when a function being sampled contains frequencies greater than the Nyquist frequency—which is the case here—these frequencies can contribute to the frequencies below the Nyquist frequency. Thus ideally a value should be selected for δx corresponding to a frequency above which there is only a small amplitude rather than the maximum frequency of interest.

Aliasing will be discussed in more detail in Chapter 8 in connection with the measurement of the Wiener spectrum of noise. For typical line spread functions there is no firm rule, but as a guide it has been suggested that the absolute error in the computed MTF will be less than 0·005 if the sampling interval is less than 25% of the half-width at half-height of the line spread function[21]. In our example the half-width at half-height is approximately 4 μm, so the sampling interval should be less than 1 μm, and this seems to be confirmed by the results of Fig. 8.

6.2 Input-output Relationships for Linear Stationary Systems

Basic Theory

A system may be defined as that which produces a set of output functions from a set of input functions. Physically the system may be an electrical circuit, in which case the input and output are time-varying voltages or currents; it may be an incoherent optical system with spatially-varying intensities as input and output; or it may be a photographic process with varying exposure as the input and, say, density as the output. Provided that certain assumptions are made about each of these systems, their input-output relationships can be analysed in a similar manner. The fact that the inputs and outputs are one-dimensional for electrical systems (functions of time) and two-dimensional for optical and photographic systems (functions of space) is of little importance. The method of analysis of electronic and optical systems are in fact so similar that Elias[6] described how he was looking forward to the

(a)

(b)

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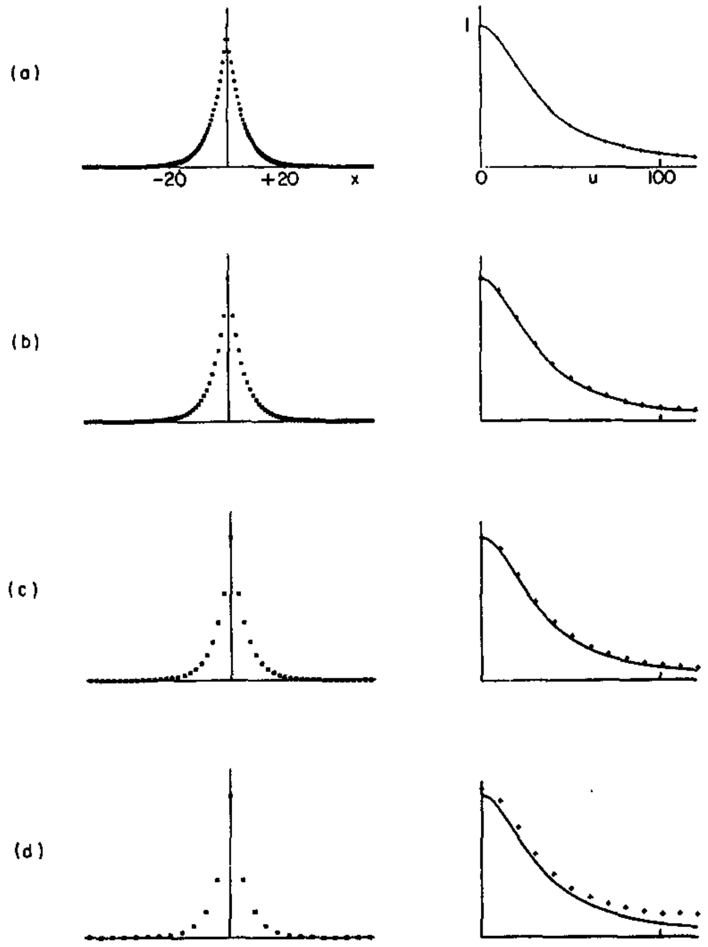

FIG. 8. The effect of sampling interval on computed FTs (see text for details).

first design for a camera lens featuring independent bass and treble control knobs!

A system can be represented by an operator S{ }, which acts on input functions to produce output functions. If $f(x,y)$ represents the input and $g(x,y)$ represents the output, then

$$g(x,y) = S\{f(x,y)\}.$$

This relationship between input and output is shown schematically in Fig. 9(a). To develop the relationship further we must restrict the nature of the system.

In this chapter we shall deal only with *linear* systems. The assumption of linearity is physically realistic for many practical systems, and leads to simple input-output relationships. However it should be noted that the photographic process behaves as a linear system only under special conditions, and is non-linear in the general case, as will be discussed in detail in the next chapter.

A system is linear if for all inputs $f_1(x,y)$ and $f_2(x,y)$ and all constants a and b:

$$S\{af_1(x,y) + bf_2(x,y)\} = a\,S\{f_1(x,y)\} + b\,S\{f_2(x,y)\}. \tag{20}$$

Basically, linearity means that if the input is broken down into an additive combination of elementary inputs, each of which gives a known output, then

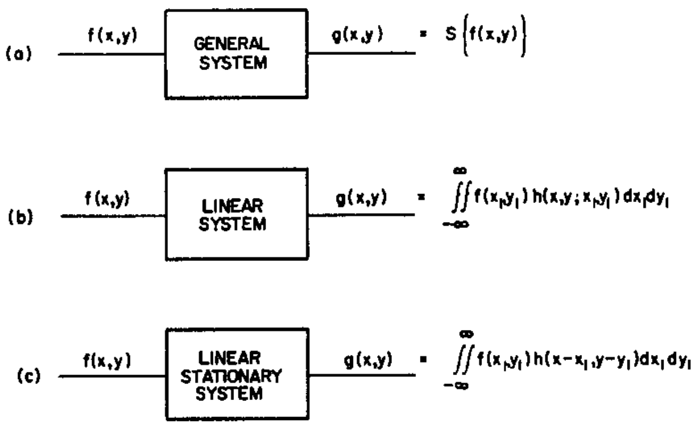

FIG. 9. Schematic representations of: (a) a general system; (b) a linear system; (c) a linear and stationary system.

the total output is found simply by adding the weighted values of the known outputs.

Using the sifting property of the delta function, as in equation (8), any input may be considered to be a linear combination of weighted and displaced delta functions:

$$f(x,y) = \iint_{-\infty}^{+\infty} f(x_1, y_1)\, \delta(x - x_1)\, \delta(y - y_1)\, dx_1 dy_1$$

The output of the system is defined by

$$g(x,y) = S\left\{\iint_{-\infty}^{+\infty} f(x_1, y_1)\, \delta(x - x_1)\, \delta(y - y_1)\, dx_1 dy_1\right\}.$$

If $f(x_1, y_1)$ is regarded as a weighting function applied to the delta functions, we may use the linearity property to bring the operator within the integral:

$$g(x, y) = \iint_{-\infty}^{+\infty} f(x_1, y_1)\, S\{\delta(x - x_1)\delta(y - y_1)\}\, dx_1\, dy_1.$$

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The line spread function is usually obtained by scanning the image of an edge trace which is converted from density or transmittance to effective exposure using the macroscopic response curve. Differentiation then gives the line spread function, and the whole scheme is illustrated in Fig. 12. It has been shown to be possible to use a relatively simple sum-and-difference calculation[39] to get from the line spread function to the square-wave or sine-wave response. However, as demonstrated in Chapter 6, Fourier transformation is a simple operation if a computer is available, and one of the advantages of the edge-trace method is that it is readily adaptable to digital recording and data processing.

The preparation of suitable test charts presents little difficulty since edges are commonly occurring objects, and a razor blade edge held in contact with

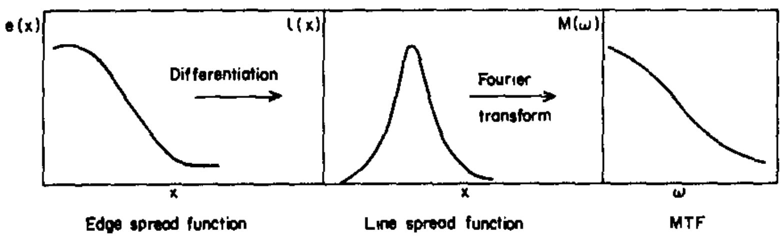

FIG. 12. Derivation of the MTF from the edge response curve.

the film may be adequate. It is more difficult to obtain low contrast edges, and special types of edge may have to be prepared if a finite transmittance is required on both sides of the edge. The main problem in the analysis of edge traces is due to the influence of image noise, as we shall see shortly.

A block diagram of the computational procedure of one particular automatic method[40,41] is shown in Fig. 13. The stages are as follows:

(1) The microdensitometer edge data is converted from arbitrary units to transmittance units, and convoluted with a microdensitometer correction function. This is more accurate than correction after the non-linear transfer of stage (2).

(2) The corrected transmittance distribution is converted to effective exposure using the macroscopic transmittance—exposure curve. A polynomial least-squares fit to this curve may be useful for implementing this stage on a computer[40], but some care has to be taken when using such techniques since errors may be introduced if large portions of the curve are fitted in this way.

(3) The data is smoothed and differentiated in a single step by convolution with a suitable function[41]. If $e(x)$ represents the effective noisy exposure edge, $e_1(x)$ the smoothed edge, and $f(x)$ the smoothing function, there will be a convolution according to

$$e_1(x) = e(x) \circledast f(x)\cdot$$

William F. Schreiber 08/709,487

Fundamentals of Electronic Imaging Systems

Some Aspects of Image Processing

Second Enlarged Edition
With 148 Figures

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in terms of some known colors. In other words, only the *appearance* of the primaries (to the standard observer) affects how they mix. This is very much different from subtractive mixtures, in which colors that look alike may produce radically different results when used, for example, as pigments.

In order to give the CIE primaries more meaning, it is necessary to be able to calculate the tristimulus values of arbitrary colors in terms thereof. To do this, we must know the tristimulus values of the spectral primaries in terms of the CIE primaries. The derivation just given is not sufficient to do that, since we have so far only specified the chromaticity of the new primaries and have said nothing about their magnitude. This last point can be settled experimentally, of course, by normalizing the CIE primaries with respect to reference white. However, the transformation can also be done theoretically by the method of Wintringham, showing that if R, G, B are tristimulus values with respect to the previously used spectral primaries, and if X, Y, Z are tristimulus values with respect to the CIE primaries, then

$$X = 2.769R + 1.752G + 1.130B$$
$$Y = 1.000R + 4.591G + 0.060B$$
$$Z = 0.000R + 0.057G + 5.593B\ .$$

In particular, if this transformation is applied to the tristimulus values of unit energy spectral colors [$R(\lambda)$, $G(\lambda)$, and $B(\lambda)$ of Fig. 7.1], then we obtain the necessary data to calculate the tristimulus values of *any* color light in terms of the CIE primaries. These curves are usually labelled $\bar{x}$, $\bar{y}$, and $\bar{z}$ and are shown in Fig. 7.6.

In actual use, for any physical color specified by its spectrophotometric curve $E(\lambda)$, we find

$$X_E = \int \bar{x}(\lambda) E(\lambda) d\lambda$$

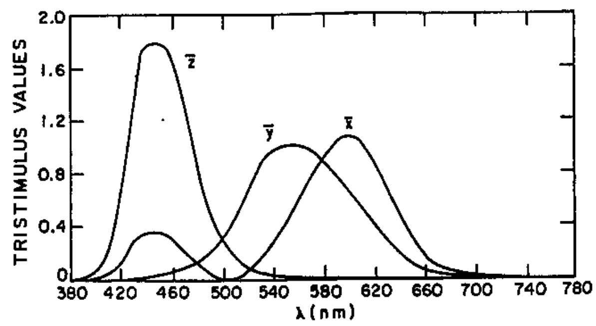


Fig. 7.6. Tristimulus values of the pure spectral colors. Like Fig. 7.1 except with respect to the CIE nonphysical primaries. White reference is still Illuminant E

7.4.3 CIE $L^*a^*b^*$ Space

This is a closed-form approximation to the empirical Munsell space and is the most uniform space in common use. It also has provision for a variable white reference, brighter than any observed color, the assumption being made that the observer adapts completely to the reference, so that the corresponding tristimulus values can simply be linearly scaled. (Note that $L^*a^*b^*$ coordinates, unlike $L^*u^*v^*$, are nonlinear, and therefore do not represent amounts of primaries.) The color-distance metric, ΔE, is the most accurate simple such metric in common use.

$$L^* = 116\left(\frac{Y}{Y_0}\right)^{1/3} - 16 \quad (.01 \le Y \le 1)$$

$$a^* = 500\left[\left(\frac{X}{X_0}\right)^{1/3} - \left(\frac{Y}{Y_0}\right)^{1/3}\right]$$

$$b^* = 200\left[\left(\frac{Y}{Y_0}\right)^{1/3} - \left(\frac{Z}{Z_0}\right)^{1/3}\right]$$

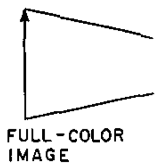
$$\Delta E = (\Delta a^{*2} + \Delta b^{*2} + \Delta L^{*2})^{1/2}\,.$$

7.5 Additive Color Reproduction

Colorimetry provides a straightforward way to design a color image reproduction system, such as color TV, where additive color synthesis is used. For example, three component images might be displayed on three white CRTs and projected in register, through three filters, onto a white screen.[8] The filtered white lights are the display primaries of the system. If the intensities of the CRTs, at corresponding points, were proportional to the tristimulus values of the corresponding point in the original scene with respect to the three primary colors (the projection filters), then an exact colorimetric match would be achieved within the gamut of the primaries. Attempts to produce colors outside of the gamut would result in negative intensity. In practice, with present-day filters or red, green, and blue phosphors, highly satisfactory color rendition is possible.

To obtain the tristimulus values needed to display the separate images, the spectral intensity, $E(\lambda)$, of each point of the scene must be multiplied by $R(\lambda)$, $G(\lambda)$, and $B(\lambda)$, the tristimulus values of the spectrum lights with respect to the display primaries, and then integrated over the visible spectrum as discussed above. In order to implement these mathematical operations with simple filters, we could divide the incoming light into three images by means of beam splitters,

[8] TV tubes having closely spaced dots or lines of three colored phosphors also effect additive synthesis when viewed from a distance at which the component images merge. Another example is the projection of red, green, and blue images in rapid sequence.



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Framework for an Image Sharpness Management System

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Lindsay MacDonald
Colour & Imaging Institute, University of Derby, United Kingdom

Abstract

A new framework for image sharpness management is proposed, analogous to the existing framework for color management systems. Knowledge of both the human visual contrast sensitivity function (CSF) and of device spatial resolution, characterized via the modulation transfer function (MTF), can be used to determine the optimum correction to be made to the sharpness of an image for specified viewing conditions, via parametric image processing techniques. The proposed framework includes profiles for spatial input and output device characteristics, connected via a profile connection space with the facility for the operator to specify a sharpness rendering intent.

Automation of Color Image Processing

The development of color management systems during the past decade has been driven by the following factors:

Cost and productivity – When image production systems need to be automated for commercial production of images of acceptable quality, it is not cost-effective to employ a skilled person to make visual judgements for each image. Batch processing and lower skill levels are essential;

Device independence – It should be possible to reproduce an image on multiple devices with the same color appearance, i.e. independent of the device or process characteristics;

Inter-operability – It should be possible to preserve the color appearance of an image when transferring it from one system to another. The destination system should be able to interpret the colors in the image to produce an equivalent visual representation of the source.

The same arguments justified the development of negative film printing systems in the past. More recently they have applied to desktop publishing in the graphic arts, and now they are driving the development of industry standards in digital video editing and broadcasting.

All the attention so far has been on color and tonal fidelity, and standards such as those of the International Color Consortium (ICC) reflect this focus.[1] Yet color and tone are not the only visual dimensions of images. Sharpness and noise are arguably of equal importance in determining the overall appearance of an image, but these have received little attention from the color imaging community. In this paper is proposed a new framework for image sharpness, which the author believes will enable new levels of image quality to be achieved economically through embedded processing within imaging systems, with a minimum of operator intervention.

Visual Contrast Sensitivity

The ability of the human eye to resolve fine spatial detail is expressed by its spatial *contrast sensitivity function* (CSF), or relative visual response as a function of ~~spatial frequency~~. Spatial contrast sensitivity depends on the scene luminance level, as shown in Figure 1 in which the retinal illuminance varies from 0.0009 trolands up to 900 trolands. The greatest sensitivity is achieved at about 8 cycles per degree, i.e. about 1 line pair per mm at 48 cm viewing distance. At lower levels of illumination (mesopic and scotopic) the sensitivity is reduced and peaks at a lower spatial frequency, becoming a low-pass instead of band-pass characteristic. The drop in photopic contrast sensitivity at low spatial frequencies can be explained by the field size exceeding the effective diameter of the center-surround receptive fields produced by the post-receptoral neural interconnections in the retina and visual cortex.[2]

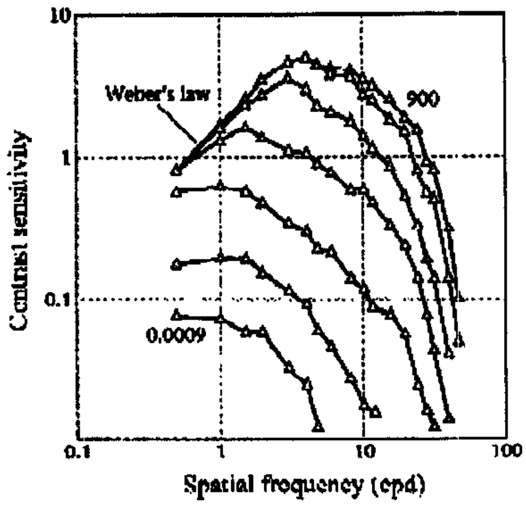

Figure 1 Contrast sensitivity as a function of spatial frequency, with retinal illuminance as a parameter (Reproduced by courtesy of Brian Wandell)

Within the retina there can be identified at least four separate receptive fields, each of which operates at a different spatial scale. These fields peak at spatial frequencies of about 1, 5, 9 and 12 cycles per degree (cpd), and combine to produce the composite contrast sensitivity function.[3] The lower two have relatively sustained temporal properties, whereas the higher two are more transient. The spatial receptive field of each region can be approximated by a difference of two Gaussian (DOG) functions.[4] Recent developments in color appearance models make use of multi-resolution processing – simulating the neural channels – filtering the image array generated by the photoreceptors into a pyramid of image components at different spatial frequencies, resulting in better predictions of induction, crispening and spreading effects than conventional models.[5]

Typical spatial CSFs for luminance contrast (black-white) and chromatic contrast (red-green and yellow-blue at constant luminance) are shown in Figure 2. The luminance CSF is band-pass in nature, approaching zero at both very low (less than 0.1 cpd) and very high (greater than 50 cpd) spatial frequencies. The chrominance CSFs have a low-pass shape, with a lower peak sensitivity and lower cut-off frequencies than the luminance CSF.[6] Only spatial patterns with frequencies less than about 5 cpd can excite the L-M (red-green') opponent neural pathway, and only spatial patterns with frequencies less than about 2 cpd can excite the S-(L+M) (blue-yellow') opponent neural pathway.[7]

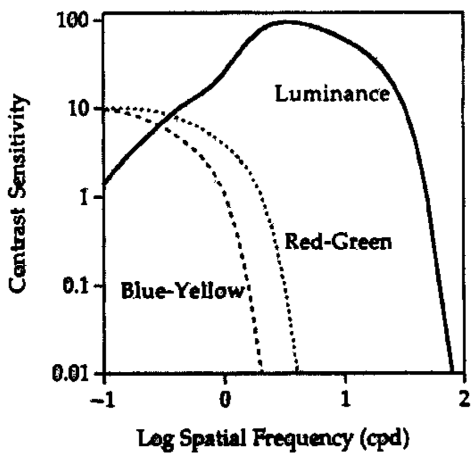

Figure 2 Contrast sensitivity functions for spatial luminance and chromatic contrast. (Reproduced by courtesy of Mark Fairchild)

Spatial interactions within the visual system lead to interactions between perceived color and sharpness. Cornsweet demonstrated that perceived brightness depends not only on the intensity of an object or region in the visual field, but also on its edge contour. By applying a localized change in intensity on either side of the edge of a region of a spinning disc, he created the illusion of a region of different lightness.[8] The effect works best when the region subtends a large visual angle (2 degrees or more), so that its spatial frequency at a normal viewing distance is low (less than 1 cpd) and hence the visual CSF is low. The effect can only be seen in luminance, not chrominance, because the opponent color channels are band-pass and do not have lower response at low spatial frequencies.

Studies have shown that spatial frequency has a strong effect on chromatic induction.[9] Changes in the spatial frequency of test stimuli caused a transition in observers' colour perception from contrast (below 1 cpd) to assimilation (at 9 cpd). In general, the spatial structure of an image must be taken into account in formulating a complete model of color appearance.[10]

Device Resolution

All imaging devices have spatial structures in their construction and therefore impose spatial characteristics on the images they capture or produce. These characteristics, combined with the point-spread effects of optical or electrical transfer functions, result in limitations on the spatial frequencies the devices can produce. One must distinguish, moreover, between *addressed resolution* and *achieved resolution*. The former is the limit of control available from the host computer, usually represented by the addressable pixel array in an image, whereas the latter is determined by the actual spatial frequency response of the device or medium, characterized in terms of its *modulation transfer function* (MTF). Achieved resolution can be defined by the spatial frequency at which the MTF has decreased to a given percentage of its peak value, typically 10%.

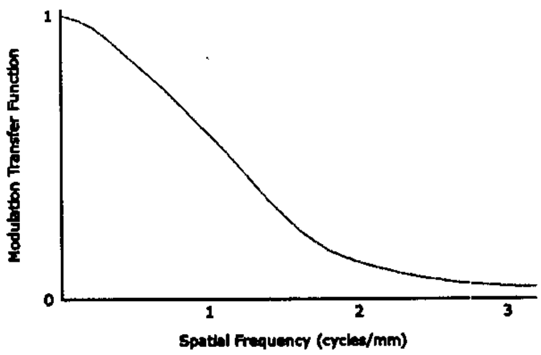

Figure 3 Modulation transfer function (MTF) of a typical desktop CRT display

MTF is a measure of how well an imaging device or system can reproduce a scene. Ideally the MTF should be high over the full range of frequencies of interest, which for human viewing means the full range of spatial frequencies to which the human visual system is sensitive under the prevailing viewing conditions. The MTF of most imaging systems is limited by the display device.[11] For cathode ray tube (CRT) displays, the MTF is determined primarily by the point-spread function of the electron beam and secondarily by bandwidth limitations in the electronics,[12]

of the overall contribution of all discernible spatial frequencies, and hence the contrast sensitivity function (CSF) of the eye must be taken into account in formulating a useful metric for image sharpness.[13,14,15]

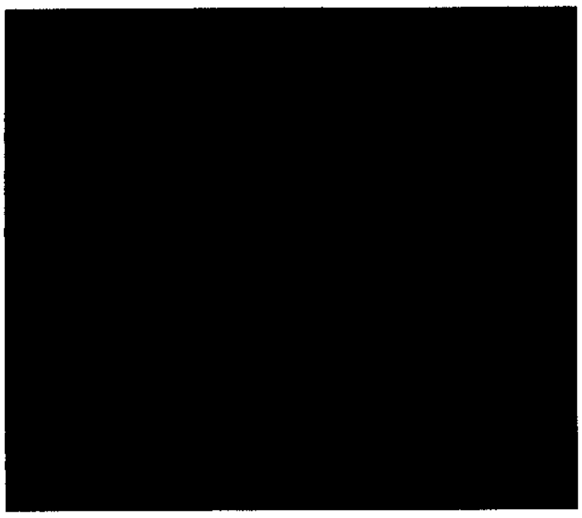

Figure 4 MTF characteristics of a 35mm film scanner for the fast and slow scanning directions (Reproduced by courtesy of Ralph Jacobson).

Different techniques may be used to determine the MTF characteristics of imaging devices. For film scanners and digital cameras, typical targets are sine wave charts with patches of different frequencies and specified modulation depth. Other techniques involve the scanning and Fourier transform of photographic grain noise patterns, and the analysis of the spatial frequency response of slanted edges.[16] Line-array scanners may exhibit different MTF characteristics in the two scanning directions, parallel and perpendicular to the CCD array, as shown in Figure 4. For displays a modulated pattern may be generated, and photographed on film or via a digital camera for analysis. The resulting system MTF is the cascaded combination of both camera and display characteristics, from which the display's MTF can be extracted.[17] Printing devices and processes are characterized by their dot size and/or halftone frequency, and can be measured via micro-line resolution targets or via photographic analysis, as for displays.[18]

Dealing with Sharpness in Image Reproduction

Sharpness can be regarded as a separate dimension of image appearance, independent of lightness, hue and chroma, as shown in Figure 5. When an image is sharp, more detail can be discerned – sharp edges permit the observer to discriminate objects more clearly, and sharp details permit the observer to recognize surface characteristics more accurately. Sharpness is lost in image capture through optical and physical limitations of the scanner or digital camera, such as aperture size, lens aberration and sampling interval. Sharpness is also lost through subsequent digital quantisation, compression and transformations such as geometric manipulation and color space conversion. Finally sharpness is lost through rendering of an image for output, for example in halftones or error diffusion for printing, or in the spatial microstructure of a display or film recorder.

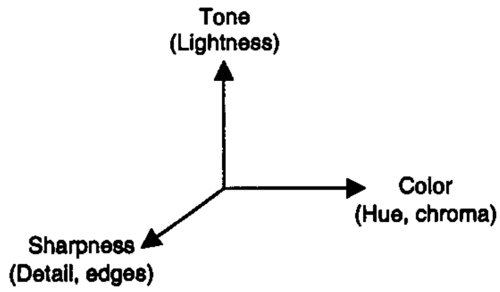

Figure 5 Three dimensions of image reproduction

Substantial improvements in image appearance can be achieved through applying the optimum amount of sharpening. For some types of image, sharpness can be argued to be a more important factor than color, in the sense that degradation of sharpness will make the image less acceptable than degradation of color. Yet sharpness is frequently overlooked as a factor in image reproduction, the assumption being that either it has been dealt with elsewhere in the system or that it is outside the control of the processing software. Certainly sharpness has received very much less attention than color for image enhancement and/or correction.

It would be possible, of course, for a user of an image reproduction system to adjust the degree of sharpness of individual images, using the editing tools provided in Adobe *Photoshop* or in other similar software. But for reasons of cost and productivity it would be highly desirable to be able to offer facilities within the computer operating system to support the semi-automated sharpness enhancement of images from any source device *en route* to any destination device. The key benefits to the customer of this approach would be as follows:

1. Enhance the visual quality of images derived from consumer digital input devices, such as digital cameras and desktop photo scanners, and also images obtained from image libraries or the Internet;
2. Support automated processing in workflows involving large numbers of images for print and multimedia applications;
3. Obtain image reproductions, in display or print, that are optimized for the viewing conditions in which they will be viewed.

Many image processing techniques, such as 'edge crispening' convolution filters and Fourier domain filters, exist for sharpness enhancement.[19] Image reproduction

systems, such as television, have built-in sharpness enhancement to compensate for MTF losses in both source (camera) and destination (display) devices. In the graphic arts industry the unsharp mask (USM) filter is well known as a means of applying sharpness enhancement to images and has been widely implemented in both scanner hardware and workstation software.[20] Most of these techniques have been developed empirically, however, with little or no sound theoretical basis, and they are usually applied to all device color channels (RGB or CMYK) simultaneously.

Because the achromatic channel of vision carries most of the sharpness information, it follows for an image encoded into separate luminance and chrominance components that the chrominance data can be sampled at lower spatial frequency without significant loss of image quality. This principle is used in the reduction of bandwidth requirements for color television broadcast systems (NTSC and PAL) and in color image compression algorithms (JPEG and MPEG).[21]

The enhancement of image sharpness should therefore be performed optimally by processing an image separately in its luminance and chrominance components, or to a good approximation by processing the luminance channel alone. This suggests that an efficient implementation of image sharpening could be achieved by processing only the lightness (L*) component of an image encoded in a uniform color space such as CIELAB or CIELUV. The sharpening filter should be designed to enhance the appropriate spatial frequencies of the image in two ways: (1) those lost because of device MTF characteristics; and (2) those required to render the image most effectively for the needs of the human visual system under the viewing conditions in which it will be seen.

Framework for Image Sharpness Management

A framework for an image sharpness management system is proposed, as shown in Figure 6, analogous to the ICC framework for color management.[1] This goes beyond previously proposed systems[22] by defining a generic structure for separately characterizing the spatial characteristics of input and output imaging devices, and a standard connection mechanism for image processing.

The spatial characteristics of the input device, including MTF and enlargement factor, would be stored in an *input profile*. These data would be used by the input transform to convert the input image into a device independent form, representing the appearance of the ideal image when viewed by an observer of standard visual acuity in a standard viewing environment at a standard viewing distance. The image in this *profile connection space* (PCS) would be perfectly corrected for the losses of sharpness caused by the optics and sampling process of the input device. In similar fashion, the spatial characteristics of the output device, including MTF and enlargement factor, would be stored in an *output profile*. These would be used by the output transform to convert the image from the PCS into the output format. This transform could optionally include characteristics of the environment under which the final image should be viewed, such as luminance level and viewing distance.

The operator of the system would also have the possibility of making editorial corrections to an image, such as sharpness enhancement, either by processing the image data directly in the profile connection space, or by adjusting the parameters of the input or output profiles. As with the practical implementation of color management systems, the source and destination profiles could be compounded into a ~~single transform for more efficient processing~~ of images.[23]

~~The concept of~~ *rendering intent* can also be applied to sharpness. Plausible rendering intents could include:

Maximize sharpness
Enhance edges
Minimize noise (grain)
Facsimile of original
Soft focus
Pleasing portrait

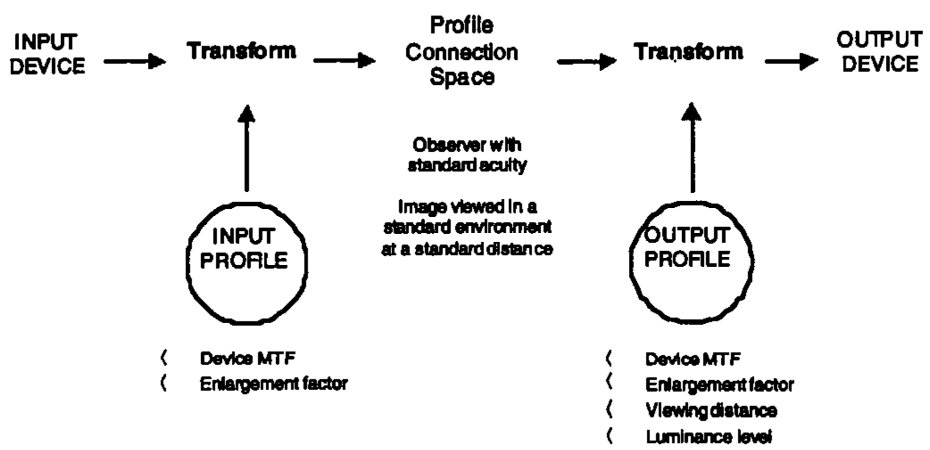

Figure 6 Framework for an image sharpness management system

More sophisticated rendering intents may apply differing degrees of sharpness enhancement in different colour components or different regions of an image. Studies of photographic color prints have shown that the subjective preference for sharpness can be enhanced through suitable filtering of the green component of the image, thereby smoothing the magenta dye component of the print.[24] A critical case is the rendering of facial portraits, in which the hair, eyebrows and lips may benefit from increased sharpness whereas skin tones may benefit from softening (reduced sharpness) in order to disguise skin pores and blemishes.[25] Such rendering may be achieved through the use of a colour-selective sharpening/softening algorithm.

The nature of the input and output media and the user's viewing task (scanning and fixation patterns, attention span, motivation, etc.) can also affect the appearance of sharpness in images. A more complete framework would therefore include corrections for the media types and the intended viewing task, such as ät a glance', protracted examination, legibility of text, discriminability of information, conspicuity of status warnings, continuity of moving images, etc.

Conclusions

Although it is arguable that sharpness is more important than color rendering in image reproduction, sharpness has not yet been properly addressed in desktop imaging systems. Sharpness losses due to the spatial sampling characteristics of imaging devices should be compensated to achieve more pleasing reproduction of images. Because human vision has much higher contrast sensitivity for achromatic luminance information, processing efficiency could be achieved by sharpening images in the luminance component alone. Sharpness management systems with architectures analogous to existing color management systems should in future fulfil this need. One way to achieve this would be to extend the ICC framework to include the additional spatial data in device profile definitions and to add sharpness enhancement to CMM processing.

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X. ATTACHMENTS

The following references as cited above are attached with their relevant pages:

1. Hunt: Title page, Copyright page, and pages 393-396;
2. Dainty and Shaw: Title page, copyright page, and pages 204-206 and 245;
3. Schreiber: Title page, copyright page, and pages 177 and 182; and
4. MacDonald: Pages 75-79.

Respectfully submitted,

Tel: 781-386-6474
Fax: 781-386-6435

Robert J. Decker
Attorney for the Applicants
Registration No. 44,056

\\NORFILE1\LEGAL\Patent\Cases\8166 RJD\8166-AMD-116.doc

UNITED S[illegible]TES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

08/709,487

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN	B [illegible]

020349 LM32/0121
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM, D	

ART UNIT	PAPER NUMBER
2721	18

DATE MAILED: 01/21/00

INTERVIEW SUMMARY

All participants (applicant, applicant's representative, PTO personnel):

(1) Dr. Bror Hultgren (Inventor) (3) Robert J. Decker (Attorney)

(2) Dr. Jay Thornton (Inventor) (4) Daniel G. Mariam

(5) Andrew Johns (Primary Examiner)

Date of Interview 1/20/00

Type: ☒ Telephonic ☐ Personal (copy is given to ☐ applicant ☐ applicant's representative).

Exhibit shown or demonstration conducted: ☐ Yes ☐ No If yes, brief description:

Agreement ☒ was reached. ☐ was not reached.

Claim(s) discussed: 1, 9, 16 and 24

Identification of prior art discussed: Stokes and Laumeyer, et al.

Description of the general nature of what was agreed to if an agreement was reached, or any other comments: Discussed issues pertinent to independent claims 1, 9, 16 and 24. Two of the inventors, indicated above, have explained the difference between the prior art and the claimed invention, particularly, Dr. Hultgren described the claimed invention second data being a device dependent transformation of spatial information content of the image, ~~in detail~~ corresponding to the prior art. Applicants' argument and explanation is persuasive, and thus the final rejection is withdrawn.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

1. ☒ It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a response to the last Office action has are ready been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

2. ☐ Since the Examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the interview unless box 1 above is also checked.

Examiner Note: You must sign this form unless it is an attachment to another form.

FORM PTOL-413 (REV.1-96)

ANDREW W. JOHNS
PRIMARY EXAMINER

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN	B	8166(RAS)

020349 LM32/0121
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM,D	
ART UNIT	**PAPER NUMBER**
2721	

DATE MAILED: 01/21/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)
*U.S. GPO: 1997-422-198/60031

1- File Copy

Notice of Allowability	**Application No.** 08/709,487	**Applicant(s)** HULTGREN ET AL.
	Examiner DANIEL G MARIAM	**Art Unit** 2721

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--
All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance and Issue Fee Due or other appropriate communication will be mailed in due course.

1. ☒ This communication is responsive to *an amendment filed on 12-30-99 & a telephone interview dated 1-20-00*.
2. ☒ The allowed claim(s) is/are *1-33*.
3. ☐ The drawings filed on ____ are acceptable.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
   a) ☐ All b) ☐ Some* c) ☐ None of the CERTIFIED copies of the priority documents have been
      1. ☐ received.
      2. ☐ received in Application No. (Series Code / Serial Number). ____ .
      3. ☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
   * Certified copies not received: ____.
5. ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

A SHORTENED STATUTORY PERIOD FOR REPLY to comply with the requirements noted below is set to EXPIRE THREE MONTHS FROM THE "DATE MAILED" of this Office Action. Failure to timely comply will result in ABANDONMENT of this application. Extensions of time may be available under the provisions of 37 CFR 1.136(a).

6. ☐ Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.

7. ☒ Applicant MUST submit NEW FORMAL DRAWINGS
   (a) ☐ because the originally filed drawings were declared by applicant to be informal.
   (b) ☒ including changes required by the Notice of Draftsperson's Patent Drawing Review(PTO-948) attached
      1) ☐ hereto or 2) ☒ to Paper No. *4*.
   (c) ☐ including changes required by the proposed drawing correction filed ____, which has been approved by the examiner.
   (d) ☐ including changes required by the attached Examiner's Amendment / Comment.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the reverse side of the drawings. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

8. ☐ Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Any reply to this letter should include, in the upper right hand corner, the APPLICATION NUMBER (SERIES CODE / SERIAL NUMBER). If applicant has received a Notice of Allowance and Issue Fee Due, the ISSUE BATCH NUMBER and DATE of the NOTICE OF ALLOWANCE should also be included.

Attachment(s)

1☐ Notice of References Cited (PTO-892)
3☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
5☐ Information Disclosure Statements (PTO-1449), Paper No. ____.
7☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
2☐ Notice of Informal Patent Application (PTO-152)
4☒ Interview Summary (PTO-413), Paper No.____ .
6☐ Examiner's Amendment/Comment
8☒ Examiner's Statement of Reasons for Allowance
9☐ Other

Allowable Subject Matter

1. Claims 1-33 are allowed.

2. The following is an examiner's statement of reasons for allowance: while describing a device dependent transformation of color information content of the image to a device independent color space is well known in a color management system as evidenced by the primary reference to Stokes, none of the prior art, however, teach or suggest a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image comprising: a data for describing a device dependent transformation of spatial information content of the image in a device independent color space. It is for this reason and in combination with all the other limitations in the claims, that independent claims 1, 9, 16 and 24 are allowable over the prior art of record. Since claims 2-8, 10-15, 17-23 and 25-33 further restrict these claims they are allowable also.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL G MARIAM whose telephone number is 703-305-4010. The examiner can normally be reached on M-F (7:00-4:30) FIRST FRIDAY OFF.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, LEO BOUDREAU can be reached on 703-305-4607. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-5397 for regular communications and 703-308-5397 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-3900.

Daniel G. Mariam
Art Unit: 2721
Examiner

January 20, 2000

Andrew W. Johns
ANDREW W. JOHNS
PRIMARY EXAMINER

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

020349 LM32/0121
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/709,487	09/06/96	033	MARIAM, D	2721	01/21/00

First Named Applicant: HULTGREN, 35 USC 154(b) term ext. = 0 Days.

TITLE OF INVENTION: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 8166(RAS)	382-276.000	H26	UTILITY	NO	$1210.00	04/21/00

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED.

THE ISSUE FEE MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED.

HOW TO RESPOND TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is changed, pay twice the amount of the FEE DUE shown above and notify the Patent and Trademark Office of the change in status, or

B. If the status is the same, pay the FEE DUE shown above.

If the SMALL ENTITY is shown as NO:

A. Pay FEE DUE shown above, or

B. File verified statement of Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.

II. Part B-Issue Fee Transmittal should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by charge to deposit account, Part B Issue Fee Transmittal should be completed and returned. If you are charging the ISSUE FEE to your deposit account, section "4b" of Part B-Issue Fee Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give application number and batch number. Please direct all communications prior to issuance to Box ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PATENT AND TRADEMARK OFFICE COPY

PTOL-85 (REV. 10-96) Approved for use through 06/30/99. (0651-0033)

*U.S. GPO: 1998-437-639/80023

PART B—ISSUE FEE TRANSMITTAL

Complete and mail this form, together with ap[plica]ble f[ees] to: Box ISSUE FEE
Assistant Commissioner for Patents
Washington, D.C. 20231

MAILING INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE. Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Issue Fee Receipt, the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)

020349 LM32/0121
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

OIPE FEB 28 2000 PATENT & TRADEMARK OFFICE

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I hereby certify that this Issue Fee Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Box Issue Fee address above on the date indicated below.

Robert J. Decker (Depositor's name)
[signature] (Signature)
February 25, 2000 (Date)

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/709,487	09/06/96	033	MARIAM, D	2721	01/21/00

First Named Applicant: HULTGREN, 35 USC 154(b) term ext. = 0 Days.

TITLE OF INVENTION: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 8166(RAS)	382-276.000	H26	UTILITY	NO	$1210.00	04/21/00

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). Use of PTO form(s) and Customer Number are recommended, but not required.

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47) attached.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Robert J. Decker
2 ______
3 ______

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)
PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.
(A) NAME OF ASSIGNEE
POLAROID CORPORATION
(B) RESIDENCE: (CITY & STATE OR COUNTRY)
784 Memorial Drive, Cambridge, MA USA
Please check the appropriate assignee category indicated below (will not be printed on the patent)
☐ individual ☐ corporation or other private group entity ☐ government

4a. The following fees are enclosed (make check payable to Commissioner of Patents and Trademarks):
☒ Issue Fee
☒ Advance Order - # of Copies 10

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☒ Advance Order - # of Copies 10

The COMMISSIONER OF PATENTS AND TRADEMARKS IS requested to apply the Issue Fee to the application identified above.

(Authorized Signature) [signature] 44,056 (Date) 2/25/00

02/29/2000 KZEWDIE1 00000016 08709487
01 FC:142 1210.00 OP
02 FC:561 30.00 OP

NOTE; The Issue Fee will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the Patent and Trademark Office.

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending on the needs of the individual case. Any comments on the amount of time required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND FEES AND THIS FORM TO: Box Issue Fee, Assistant Commissioner for Patents, Washington D.C. 20231

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Assistant Commissioner for Patents
Washington, D.C. 20231

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RENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)

020349 LM32/0121
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

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Robert J. Decker (Depositor's name)
[signature] (Signature)
February 25, 2000 (Date)

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/709,487	09/06/96	033	MARIAM, D	2721	01/21/00

rst Named pplicant: HULTGREN, 35 USC 154(b) term ext. = 0 Days.

E OF NTION: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 8166(RAS)	382-276.000	H26	UTILITY	NO	$1210.00	04/21/00

Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). Use of PTO form(s) and Customer Number are recommended, but not required.

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47) attached.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Robert J.Decker
2
3

ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)
PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE
POLAROID CORPORATION

(B) RESIDENCE: (CITY & STATE OR COUNTRY)
784 Memorial Drive, Cambridge, MA USA

Please check the appropriate assignee category indicated below (will not be printed on the patent)
☐ individual ☐ corporation or other private group entity ☐ government

4a. The following fees are enclosed (make check payable to Commissioner of Patents and Trademarks):
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uthorized Signature) [signature] 44,056 (Date) 2/25/00

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#30 Draft

Docket No. 8166/RJD **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit: 2721 Batch No.: H26
Application of: Hultgren et al. Examiner: D. Mariam
Serial No.: 08/709,487 Filed: September 6, 1996
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

BOX ISSUE FEE
Assistant Commissioner for Patents
Washington, D.C. 20231

Attention: Official Draftsperson

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Date: February 25, 2000

Robert J. Decker
Registration No. 44,056

SUBSTITUTE DRAWINGS UNDER RULE 1.85

Sir:

In response to the requirement in the Notice of Allowability, enclosed herewith are 3 sheets of substitute drawings (Figs 1-4) in the subject-named application to replace the corresponding sheets in accordance with the provisions of Rule 1.85. The undersigned states that each one of the sheets is a true copy of the corresponding drawings as filed, modified:

_X_ to meet the requirements of PTO-948 dated October 26, 1996 (mailed with Paper No. 4 on December 10, 1997)

_X_ to incorporate changes in accordance with the redline drawings filed on July 14, 1999.

Respectfully submitted,

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

Tel: 781-386-6474
Fax: 781-386-6435

\\NORFILE1\LEGAL\Patent\Cases\8166 RJD\8166 SubmitDrawings.doc

6128415

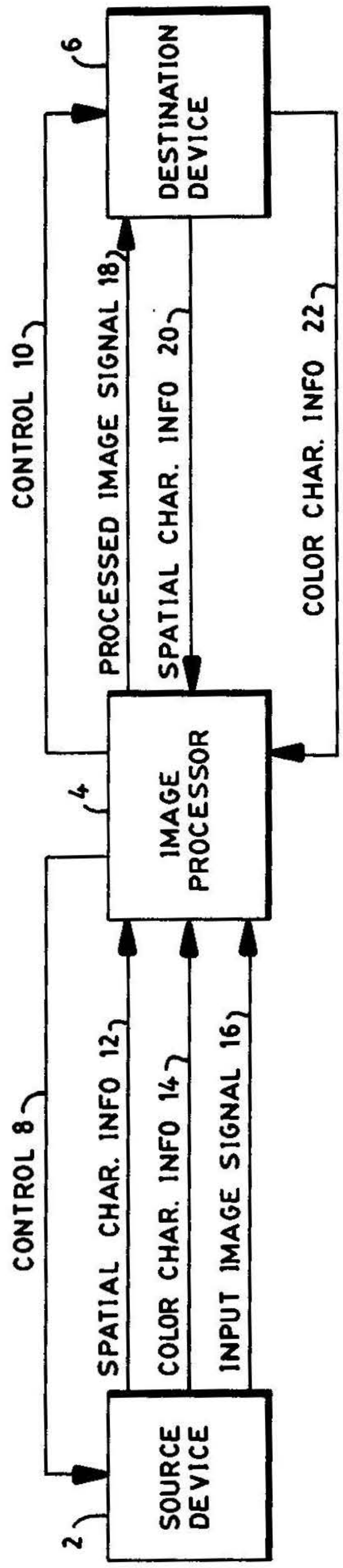

FIG. 1

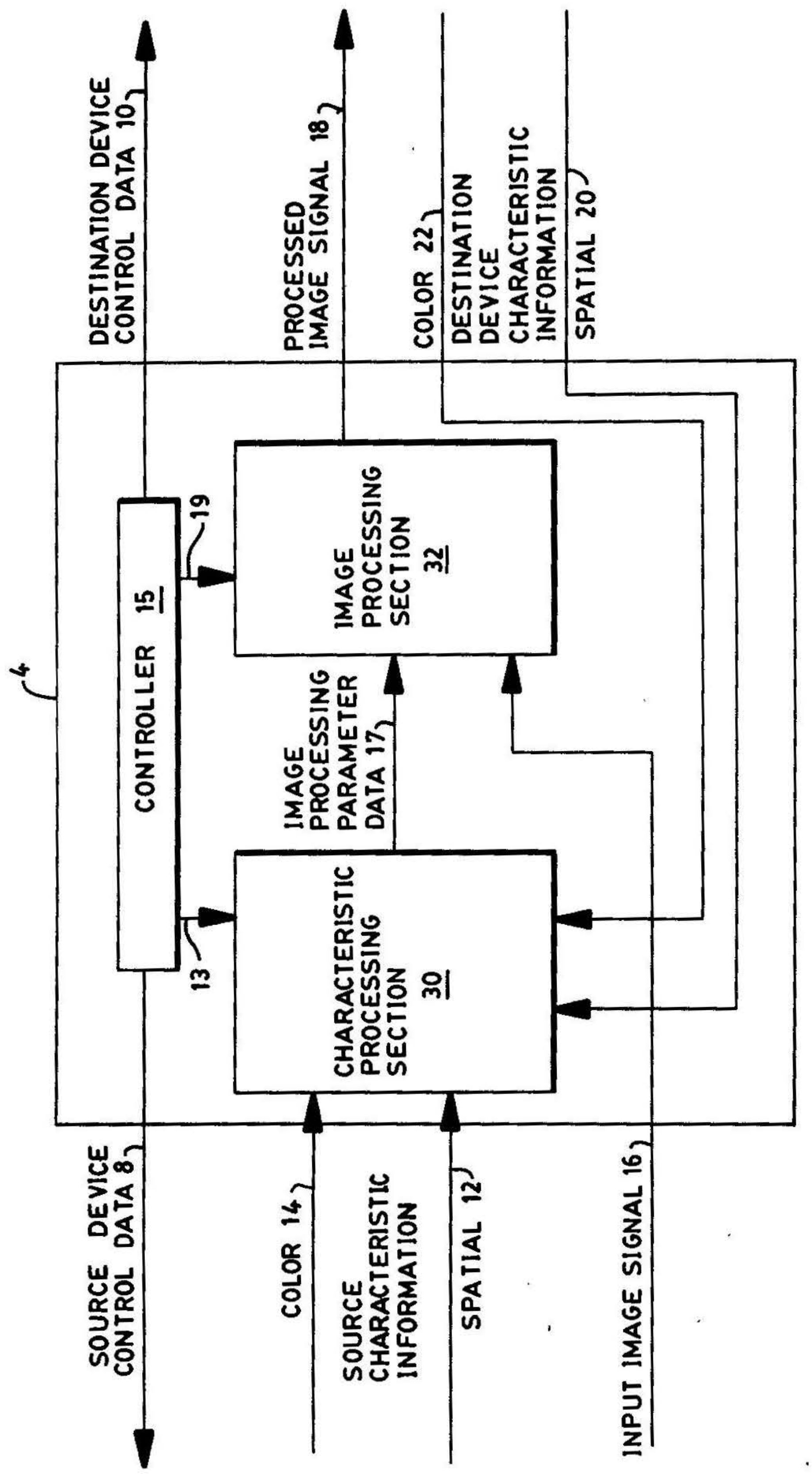
4
DESTINATION DEVICE CONTROL DATA 10
PROCESSED IMAGE SIGNAL 18
COLOR 22
DESTINATION DEVICE CHARACTERISTIC INFORMATION
SPATIAL 20
CONTROLLER 15
19
13
IMAGE PROCESSING SECTION 32
IMAGE PROCESSING PARAMETER DATA 17
CHARACTERISTIC PROCESSING SECTION 30
SOURCE DEVICE CONTROL DATA 8
COLOR 14
SOURCE CHARACTERISTIC INFORMATION
SPATIAL 12
INPUT IMAGE SIGNAL 16

FIG. 2

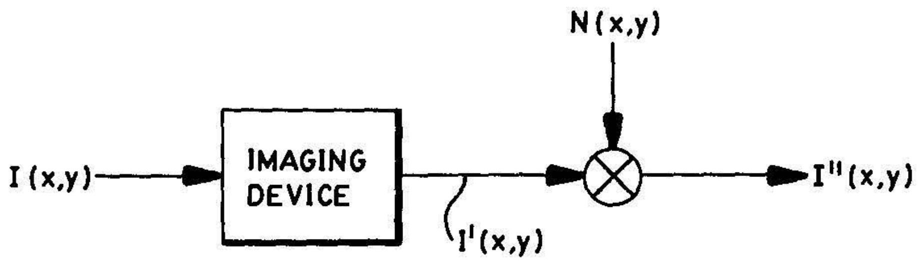
N(x,y)
I(x,y)
IMAGING DEVICE
I'(x,y)
I''(x,y)

FIG. 3

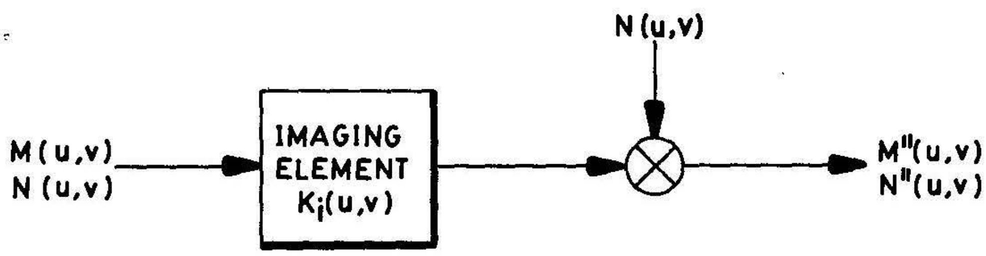
N(u,v)
M(u,v)
N(u,v)
IMAGING ELEMENT
K_i(u,v)
M''(u,v)
N''(u,v)

FIG. 4

#8

FEB 28 2000

C-8166/RJD

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit: 2721
Application of: Hultgren et al.
Serial No.: 08/709,487
Filed: September 6, 1996
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Batch No.: H26
Examiner: D. Mariam

Cambridge, Massachusetts 02139
February 25, 2000

Box Issue Fee
Assistant Commissioner for Patents
Washington, DC 20231

ISSUE FEE TRANSMITTAL (37 C.F.R. § 1.311) AND ADVANCE COPY ORDER

Dear Sir:

With respect to the above referenced application, please find enclosed Check No. 10799 in the amount of $1240 in payment of the issue fee together with an advance order for ten (10) copies of the patent to be issued.

Please charge any additional fee due, or credit any overpayment, to Deposit Account No. 16-2195. A duplicate copy of this paper is enclosed.

NOTE: SUBSTITUTE DRAWINGS BEING CONCURRENTLY FILED HEREIN.

Respectfully submitted,

Robert J. Decker
Registration No. 44,056

Tel: 617-386-6474

RJD:lmh
Enclosures: PTOL-85B, Check No. 10799, duplicate copy of paper, postcard, 4 Drawings

CERTIFICATE OF MAILING (37 C.F.R. §1.8)

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Date: February 25, 2000

Robert J. Decker
Registration No. 44,056

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Patent and T' Office
ASSISTANT SECRETA. , D COMMISSIONER
OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

CHANGE OF ADDRESS/POWER OF ATTORNEY

FILE LOCATION 9200 SERIAL NUMBER 08709487 PATENT NUMBER 6128415

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THE PRACTITIONERS OF RECORD HAVE BEEN CHANGED TO CUSTOMER # 20349

THE FEE ADDRESS HAS BEEN CHANGED TO CUSTOMER # 20349

ON 05/09/03 THE ADDRESS OF RECORD FOR CUSTOMER NUMBER 20349 IS:

POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

AND THE PRACTITIONERS OF RECORD FOR CUSTOMER NUMBER 20349 ARE:

24359 25173 25778 25937 26378 33740 34442 35344 36780 40049
40256 45934

PTO INSTRUCTIONS: PLEASE TAKE THE FOLLOWING ACTION WHEN THE CORRESPONDENCE ADDRESS HAS BEEN CHANGED TO CUSTOMER NUMBER: RECORD, ON THE NEXT AVAILABLE CONTENTS LINE OF THE FILE JACKET, 'ADDRESS CHANGE TO CUSTOMER NUMBER'. LINE THROUGH THE OLD ADDRESS ON THE FILE JACKET LABEL AND ENTER ONLY THE 'CUSTOMER NUMBER' AS THE NEW ADDRESS. FILE THIS LETTER IN THE FILE JACKET. WHEN ABOVE CHANGES ARE ONLY TO FEE ADDRESS AND/OR PRACTITIONERS OF RECORD, FILE LETTER IN THE FILE JACKET.
THIS FILE IS ASSIGNED TO GAU 0000.

PTO-FMD
TALBOT-1/97

```
     (FILE 'USPAT' ENTERED AT 10:38:47 ON 10 APR 1999)
L1          32 S SPATIAL  (P) DEVICE(3A)INDEPENDENT
L2           5 S L1 (P) (TRANSFORM? OR TRANSFORMATION)
L3           1 S 5379122/PN
L4           1 S L3 AND DEVICE INDEPENDENT
L5        2618 S DEVICE(3A)PROFILE#
L6          46 S L5 (P) INDEPENDENT
```

```
     (FILE 'HOME' ENTERED AT 08:35:52 ON 06 MAY 1998)

     FILE 'INSPEC, WPIDS, EUROPATFULL, USPATFULL' ENTERED AT 08:36:07 ON
     06 MAY 1998
L1          111 S DEVICE(5A)INDEPENDENT(10A)(TRANSFORM? OR TRANSFORMATION
L2           56 S L1 AND DEVICE(3A)DEPENDENT
L3           45 S L2 AND COLOR(3A)SPACE
L4           12 S L3 AND DIGIT?(3A)IMAGE#
```

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 1995

Application or Docket Number: 08709487

CLAIMS AS FILED - PART I

FOR	NUMBER FILED (Column 1)		NUMBER EXTRA (Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE					375.00	OR		750.00
TOTAL CLAIMS	31	minus 20 =	* 11	x$11=		OR	x$22=	242
INDEPENDENT CLAIMS	4	minus 3 =	* 1	x39=		OR	x78=	78
MULTIPLE DEPENDENT CLAIM PRESENT				+125=		OR	+250=	
				TOTAL		OR	TOTAL	1070

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x39=		OR	x78=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+125=		OR	+250=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x39=		OR	x78=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+125=		OR	+250=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x39=		OR	x78=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+125=		OR	+250=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875
(Rev. 10/95)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Form PTO 1130
(REV 2/94)

PACE DATA ENTRY CODING SHEET

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

1ST EXAMINER	DATE 101596
2ND EXAMINER	DATE

APPLICATION NUMBER	TYPE APPL	FILING DATE (MONTH DAY YEAR)	SPECIAL HANDLING	GROUP ART UNIT	CLASS	SHEETS OF DRAWING
08/709487	1	09 06 96	0	2606	382	003

TOTAL CLAIMS	INDEPENDENT CLAIMS	SMALL ENTITY?	FILING FEE	FOREIGN LICENSE	ATTORNEY DOCKET NUMBER
031	004	0	1070	√	8166(RAS)

CONTINUITY DATA

CONT CODE	STATUS CODE	PARENT APPLICATION SERIAL NUMBER	PCT APPLICATION SERIAL NUMBER	PARENT PATENT NUMBER	PARENT FILING DATE (MONTH DAY YEAR)
			PCT/ /		
			PCT/ /		
			PCT/ /		
			PCT/ /		
			PCT/ /		

PCT/FOREIGN APPLICATION DATA

FOREIGN PRIORITY CLAIMED	COUNTRY CODE	PCT/FOREIGN APPLICATION SERIAL NUMBER	FOREIGN FILING DATE (MONTH DAY YEAR)
N			

MULTIPLE DEPENDENT CLAIM
FEE CALCULATION SHEET
(FOR USE WITH FORM PTO-875)

SERIAL NO. 709487

FILING DATE

APPLICANT(S)

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT			*		*		*	
	IND	DEP	IND	DEP	IND.	DEP.		IND.	DEP.	IND.	DEP.	IND.	DEP
1							51						
2							52						
3							53						
4							54						
5							55						
6							56						
7							57						
8							58						
9							59						
10							60						
11							61						
12							62						
13							63						
14							64						
15							65						
16							66						
17							67						
18							68						
19							69						
20							70						
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28							78						
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31							81						
32							82						
33							83						
34							84						
35							85						
36							86						
37							87						
38							88						
39							89						
40							90						
41							91						
42							92						
43							93						
44							94						
45							95						
46							96						
47							97						
48							98						
49							99						
50							100						
TOTAL IND							TOTAL IND.						
TOTAL DEP							TOTAL DEP.						
TOTAL							TOTAL						

ICC Profile Format Specification

Version 3.10b

October 21, 1995

International Color Consortium

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For additional information on the ICC:

Todd Newman, Chairman International Color Consortium

Silicon Graphics, Inc.
2011 N. Shoreline Blvd., MS 911
Mountain View, CA 94043
Phone: (415) 390-1614
Internet: tdn@sgi.com

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Xerox Corporation

Table of Contents

0 Introduction

This specification describes the International Color Profile Format. The intent of this format is to provide a cross-platform device profile format.Such device profiles can be used to translate color data created on one device into another device's native color space. The acceptance of this format by operating system vendors allows end users to transparently move profiles and images with embedded profiles between different operating systems. For example, this allows a printer manufacturer to create a single profile for multiple operating systems.

A large number of companies and individuals from a variety of industries participated in very extensive discussions on these issues. Many of these discussions occurred under the auspices of Forshungsgesellschaft Druck e.V. (FOGRA), the German graphic arts research institute during 1993. The present specification evolved from these discussions and the ColorSync™ 1.0 profile format.

This is a very complex set of issues and the organization of this document strives to provide a clear, clean, and unambiguous explanation of the entire format. To accomplish this, the overall presentation is from a top-down perspective, beginning with a summary overview and continuing down into more detailed specifications to a byte stream description of format.

0.1 Intended Audience

This specification is designed to provide developers and other interested parties a clear description of the profile format. A nominal understanding of color science is assumed, such as familiarity with the CIELAB color space, general knowledge of device characterizations familiarity of at least one operating system level color management system.~~operating system level color management system.~~

0.2 Organizational Description of This Specification

This specification is organized into a number of major clauses and annexes. Each clause and subclause is numbered for easy reference. A brief introduction is followed by a detailed summary of the issues involved in this document including: International Color Consortium, device profiles, the profile connection space (PCS), tagged element structure, embedded profiles, profile classifications, color transformations, and color model arbitration.

Clause 1 described the scope of this specification.

Clause 2 provides the normative references for this specification.

Clause 3 described the conformance requirements for this specification.

Clause 4 provides general a definitions used within this standard.

Clause 5 provides descriptions of notations, symbols and abbreviations used in this specification.

Clause 6 described the requirements of this specification. Sub-clause 6.1 'Header Description' describes the format header definition. Sub-clause 6.2 'Tag Table Definition' describes the tag table. Sub-clause 6.3 'Device Profile Requirements' provides a top level view of what tags are required for each type of profile classification and a brief description of the algorithmic models associated with these classes along. Four additional color transformation formats are also described: device link, color space conversion, abstract transformations, and named color transforms. Sub-clause 6.4 'Tag Descriptions' is a detailed algorithmic and intent description of all of the tagged elements described in the previous sections. Sub-clause 6.5 'Tag Type Definitions' provides a byte stream definition of the structures that make up the tags in clause 6.4.

Annex A : 'Color Spaces' describes the color spaces used in this specification. Annex B : 'Embedding Profiles' provides the necessary details to embed profiles into PICT, TIFF, and EPS files. Annex C : 'C Header File Example' provides cross-platform ANSI-C compatible header file example for each of the device profile and color transform formats. Annex D : 'PostScript Level 2 Tags' provides a general description of the PostScript Level 2 tags used in this specification. Annex E : 'Profile Connection Space Explanation' is a paper describing details of the profile connection space.

0.3 International Color Consortium

Considering the potential impact of this standard on various industries, a consortium has been formed that will administer this specification and the registration of tag signatures and descriptions. The founding members of this consortium include; Adobe Systems Inc., Agfa-Gevaert N.V., Apple Computer, Inc., Eastman Kodak Company, FOGRA (Honorary), Microsoft Corporation, Silicon Graphics, Inc., Sun Microsystems, Inc., and Taligent, Inc. These companies have committed to fully support this specification in their operating systems, platforms and applications.

0.4 Device Profiles

Device profiles provide color management systems with the information necessary to convert color data between native device color spaces and device independent color spaces. This specification divides color devices into three broad classifications: input devices, display devices and output devices. For each device class, a series of base algorithmic models are described which perform

the transformation between color spaces. These models provide a range of color quality and performance results. Each of the base models provides different trade-offs in memory footprint, performance and image quality. The necessary parameter data to implement these models is described in the required portions on the appropriate device profile descriptions. This required data provides the information for the color management framework default color management module (CMM) to transform color information between native device color spaces. A representative architecture using these components is illustrated in Figure 1 below.

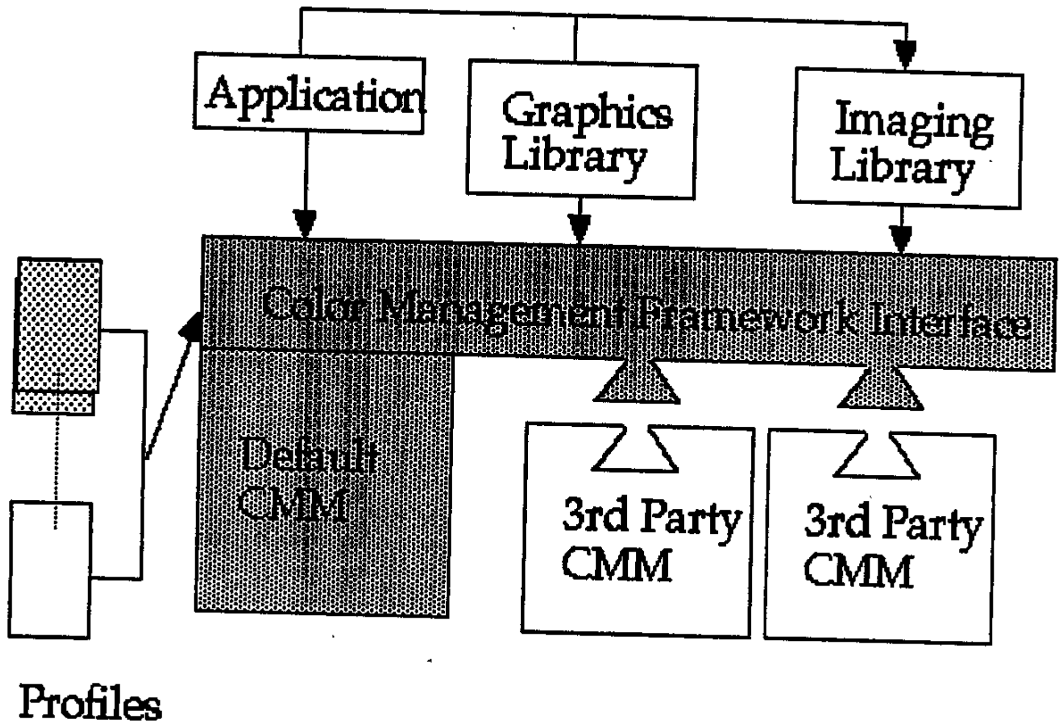


FIGURE 1.

0.5 Profile Element Structure

The profile structure is defined as a header followed by a tag table followed by a series of tagged elements that can be accessed randomly and individually. This collection of tagged elements provides three levels of information for developers: required data, optional data and private data. An element tag table provides a table of contents for the tagging information in each individual profile. This table includes a tag signature and the beginning address offset and size of the data for each individual tagged element. Signatures in this specification are defined as a four byte hexadecimal number. This tagging scheme allows developers to read in the element tag table and then randomly

access and load into memory only the information necessary to their particular software application. Since some instances of profiles can be quite large, this provides significant savings in performance and memory. The detailed descriptions of the tags, along with their intent, are included later in this specification.

The required tags provide the complete set of information necessary for the default CMM to translate color information between the profile connection space and the native device space. Each profile class determines which combination of tags is required. For example, a multi-dimensional lookup table is required for output devices, but not for display devices.

In addition to the required tags for each device profile, a number of optional tags are defined that can be used for enhanced color transformations. Examples of these tags include PostScript Level 2 support, calibration support, and others. In the case of required and optional tags, all of the signatures, an algorithmic description, and intent are registered with the International Color Consortium.

Private data tags allow CMM developers to add proprietary value to their profiles. By registering just the tag signature and tag type signature, developers are assured of maintaining their proprietary advantages while maintaining compatibility with the industry standard. However, the overall philosophy of this format is to maintain an open, cross-platform standard, therefore the use of private tags should be kept to an absolute minimum.

0.6 Embedded Profiles

In addition to providing a cross-platform standard for the actual disk-based profile format, this specification also describes the convention for embedding these profiles within graphics documents and images. Embedded profiles allow users to transparently move color data between different computers, networks and even operating systems without having to worry if the necessary profiles are present on the destination systems. The intention of embedded profiles is to allow the interpretation of the associated color data. Embedding specifications are described in Annex B : 'Embedding Profiles' of this document.

0.7 Registration Authority

This standard requires that signatures for CMM type, device manufacturer, device model, profile tags and profile tag types be registered to insure that all profile data is uniquely defined. The registration authority for these data is the ICC Technical Secretary:

Michael Has
FOGRA

Streitfieldstrasse 19
D-81673 Munich, Germany
Tel: 49-89-4318241
Fax: 49-89-431-6896.

If and when this document becomes an International Standard this registration responsibility must be brought into conformance with ISO procedures. These procedures are being investigated on behalf of ICC and TC130.

0.8 Redundant Data Arbitration

There are several methods of color rendering described in the following structures that can function within a single CMM. If data for more than one method are included in the same profile, the following selection algorithm should be used by the software implementation: if an 8 bit or 16 bit lookup table is present, it should be used; if a lookup table is not present (and not required), the appropriate default modeling parameters are used.

1 Scope

This International Standard defines the data necessary to describe the color characteristics used to input, display, or output images, and an associated file format for the exchange of this data.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

CIE Publication 15.2-1986, "Colorimetry"

ISO 5/1:1984, "Photography (sensitometry) - Density measurements - Terms, symbols and notation"

ISO 5/2:1991, "Photography- Density measurements - Part 2: Geometric conditions for transmission density"

ISO 5/4:1983, "Photography - Density measurements - Part 4: Geometric conditions for reflection density"

ISO/IEC 646:1991, Information technology - ISO 7-bit coded character set for information interchange.

ISO 3664:1975, "Photography - Illumination conditions for viewing colour transparencies and their reproductions" (Need to check against ANSI PH2.30-1989)

ISO 12641- 199X, Graphic technology - Prepress digital data exchange - Colour targets for input scanner calibration (Equals IT8.7/1 and IT8.7/2)

ISO 12642 - 199X, Graphic technology - Prepress digital data exchange - Input data for characterization of 4-colour process printing (Equals IT8.7/3)

ISO 13655 - 199X, Graphic technology - Spectral measurement and colorimetric computation for images (Equals CGATS.5)

CIE 15.2-1986, Colorimetry, Second Edition

PostScript - Language Reference Manual, Second Edition, Adobe Systems Inc., Second Edition

TIFF 6.0 Specification, published by Adobe Systems Inc.,

PICT Standard Specifications, published by APPLE Computers,

3 Conformance

Any color management system, application, utility or device driver that is in conformance with this standard shall have the ability to read the profiles as they are defined in this standard. Any profile generating software and/or hardware that is in conformance with this standard shall have the ability to create profiles as they are defined in this standard. ICC conforming software will use the ICC profiles in an appropriate manner.

4 Definitions

For the purposes of this standard, the following definitions shall apply:

4.1 aligned

A data element is aligned with respect to a data type if the address of the data element is an integral multiple of the number of bytes in the data type.

4.2 ASCII

a string of bytes, each containing a graphic character from ISO 646, the last character in the string being a "null" (character 0/0)

4.3 BCD

Binary Coded Decimal

4.4 big-endian

addressing the bytes within a short or long from the most significant to the lest significant, as the byte address increases

4.5 BYTE

an eight-bit unsigned binary integer

4.6 CMM

Color Management Module

4.7 Fixed Point Math

(We need a definition of Fixed Point Math)

Note: Many of the tag types contain fixed point numbers..Several references can be found (Nethou MetaFonts, etc.) illustrating the preferability of fixed point math to pure floating point math in very structured circumstances.

4.8 little-endian

addressing the bytes within a short or long from the least significant to the most significant, as the byte address increases

4.9 LONG

a 32-bit unsigned binary integer

4.10 offset

an address within a TIFF/IT file, relative to byte zero of the file

4.11 offset value

a short or long value within a TIFF/IT file, containing the offset of a data element

4.12 perceptual

A rendering intent that specifies the full gamut of the image is compressed or expanded to fill the gamut of the destination device. Gray balance is preserved but colorimetric accuracy might not be preserved.

4.13 Rendering Intent

Rendering intent specifies the style of reproduction to be used during the evaluation of this profile in a sequence of profiles. It applies specifically to that profile in the sequence and not to the entire sequence. Typically, the user or application will set the rendering intent dynamically at runtime or embedding time.

4.14 saturation

A rendering intent that specifies the saturation of the pixels in the image is preserved perhaps at the expense of accuracy in hue and lightness.

4.15 SHORT

a 16-bit unsigned binary integer

4.16 TIFF

the TIFF 6.0 specification published by Adobe Corporation

4.17 word-aligned sequence

an even number of consecutive bytes beginning at an even offset.

5 Notation, symbols and abbreviations

All numeric values in this standard are expressed in decimal, unless otherwise indicated and literal strings are denoted in this standard by enclosing them in single quotation marks.

The following symbols and abbreviations are used in this specification.

5.1 General

5.1.1 **BP:** Byte position within a label. For ease of use with ISO 1001, byte positions start at 1.

5.1.2 **h:** A letter "h" is suffixed to denote a hexadecimal value.

5.1.3 **L:** Length of field in number of byte positions.

5.1.4 **SPACE or "b"**: The character coded in position 2/0 of ISO/IEC 646.

5.1.5 **ZERO:** The character coded in position 3/0 of ISO/IEC 646.

5.2 Basic Numeric Types

5.2.1 **dateTimeNumber:** This dateTimeNumber is a 12 byte value representation of the time and date. The actual values are encoded as 16 bit unsigned integers.

Byte Position	Field name
0-1	number of the year (actual year, i.e. 1994)
2-3	number of the month (1-12)
4-5	number of the day of the month (1-31)
6-7	number of hours (0-23)
8-9	number of minutes (0-59)
10-11	number of seconds (0-59)

TABLE 1.

5.2.2 **s15Fixed16Number** (s15.16): This type represents a fixed signed 4 byte/32

bit quantity which has 16 fractional bits. An example of this encoding is:

-32768.0	80000000h
0	00000000h
1.0	00010000h
32767 + (65535/65536)	7fffffffh
-32768.0	80000000h

TABLE 2.

5.2.3 **u6Fixed6Number:** This type represents a fixed unsigned 2 byte/16 bit quantity which has 8 fractional bits. An example of this encoding is:

0	0000h
1.0	0100h
255 + (255/256)	ffffh

TABLE 3.

5.2.4 **uInt16Number:** This type represents a generic unsigned 2 byte/16 bit quantity.

5.2.5 **uInt32Number:** This type represents a generic unsigned 4 byte/32 bit quantity.

5.2.6 **uInt64Number:** This type represents a generic unsigned 8 byte/64 bit quantity.

5.2.7 **uInt8Number:** This type represents a generic unsigned 1 byte/8 bit quantity.

5.2.8 **XYZNumber:** This type represents a set of three fixed signed 4 byte/32 bit quantities used to encode CIEXYZ tristimulus values where byte usage is assigned as follows:

BP	Content	Encoding
0-3	CIE X	s15Fixed16Number
4-7	CIE Y	s15Fixed16Number
8-11	CIE Z	s15Fixed16Number

TABLE 4.

For relative tristimulus values, the XYZNumbers are scaled such that a

perfect reflecting diffuser has a Y value of 1.0 and NOT 100.0.

5.2.9 Seven Bit ASCII

Hexademimal															
00	nul	01	soh	02	stx	03	etx	04	eot	05	enq	06	ack	07	bel
08	bs	09	ht	0a	nl	0b	vt	0c	np	0d	cr	0e	so	0f	si
10	dle	11	dc1	12	dc2	13	dc3	14	dc4	15	nak	16	syn	17	etb
18	can	19	em	1a	sub	1b	esc	1c	fs	1d	gs	1e	rs	1f	us
20	sp	21	!	22	"	23	#	24	$	25	%	26	&	27	'
28	(	29	)	2a	*	2b	+	2c	,	2d	-	2e	.	2f	/
30	0	31	1	32	2	33	3	34	4	35	5	36	6	37	7
38	8	39	9	3a	:	3b	;	3c	<	3d	=	3e	>	3f	?
40	@	41	A	42	B	43	C	44	D	45	E	46	F	47	G
48	H	49	I	4a	J	4b	K	4c	L	4d	M	4e	N	4f	O
50	P	51	Q	52	R	53	S	54	T	55	U	56	V	57	W
58	X	59	Y	5a	Z	5b	[	5c	\	5d	]	5e	^	5f	_
60	`	61	a	62	b	63	c	64	d	65	e	66	f	67	g
68	h	69	i	6a	j	6b	k	6c	l	6d	m	6e	n	6f	o
70	p	71	q	72	r	73	s	74	t	75	u	76	v	77	w
78	x	79	y	7a	z	7b	{	7c	7d	}	7e	~	7f	del	

TABLE 5.

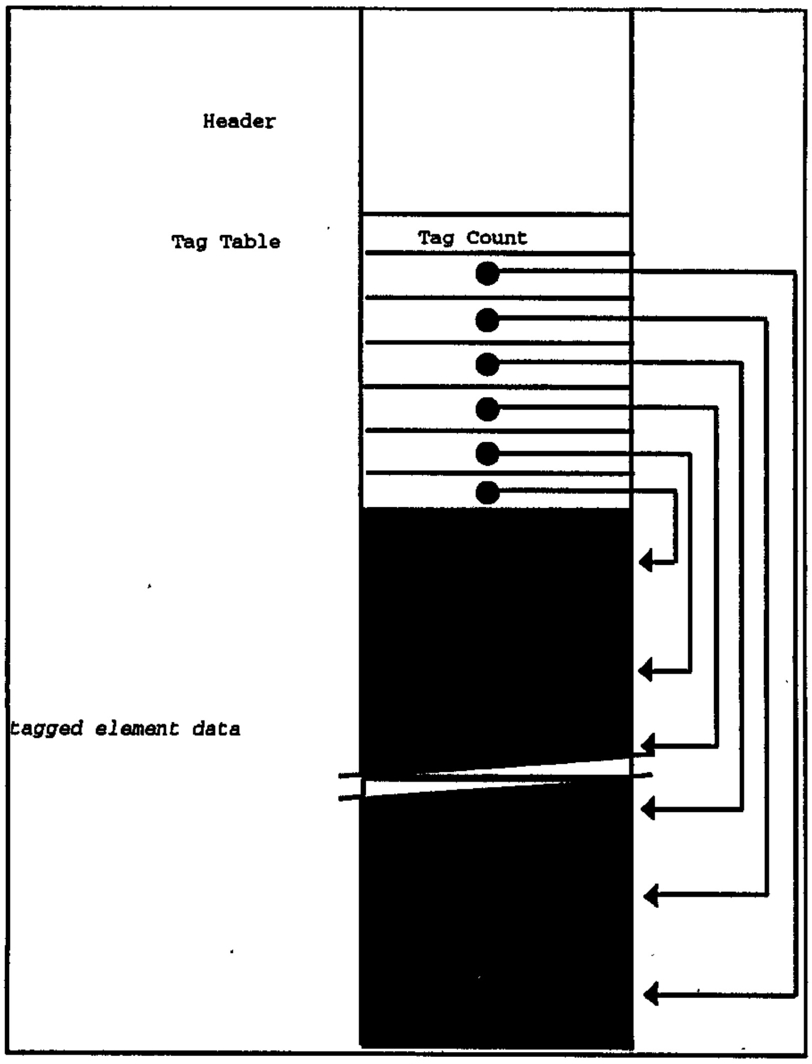
Decimal															
000	nul	001	soh	002	stx	003	etx	004	eot	005	enq	006	ack	007	bel
010	bs	011	ht	012	nl	013	vt	014	np	015	cr	016	so	017	si
020	dle	021	dc1	022	dc2	023	dc3	024	dc4	025	nak	026	syn	027	etb
030	can	031	em	032	sub	033	esc	034	fs	035	gs	036	rs	037	us
040	sp	041	!	042	"	043	#	044	$	045	%	046	&	047	'
50	(	051	)	052	*	053	+	054	,	055	-	056	.	057	/
060	0	061	1	062	2	063	3	064	4	065	5	066	6	067	7
070	8	071	9	072	:	073	;	074	<	075	=	076	>	077	?
100	@	101	A	102	B	103	C	104	D	105	E	106	F	107	G
110	H	111	I	112	J	113	K	114	L	115	M	116	N	117	O
120	P	121	Q	122	R	123	S	124	T	125	U	126	V	127	W
130	X	131	Y	132	Z	133	[	134	\	135	]	136	^	137	_
140	`	141	a	142	b	143	c	144	d	145	e	146	f	147	g
150	h	151	i	152	j	153	k	154	l	155	m	156	n	157	o
160	p	161	q	162	r	163	s	164	t	165	u	166	v	167	w
170	x	171	y	172	z	173	{	174	175	}	176	~	177	del	

TABLE 6.

6 Requirements

A color data exchange device color profile shall include the following elements, in the order shown below in Figure 2, as a single file.

FIGURE 2. Profile Map



The 128 byte file header as defined in clause 6.1 'Header Description'.

The tag table as defined in clause 6.2 'Tag Table Definition'.

The tag data elements in accordance with the requirements of clauses 6.3 'Device Profile Requirements', 6.4 'Tag Descriptions' and 6.5 'Tag Type Definitions'.

Note: The information necessary to understand and create the Tag Data Elements is arranged within this standard as follows. Each class, and subclass, of device (e.g.: input, RGB) requires the use of specific tags and allows other optional tags. These relationships are described in clause 6.3 'Device Profile Requirements'. Tags themselves are described in clause 6.4 'Tag Descriptions'. However tag descriptions draw upon a series of commonly used "tag types" which are defined in clause 6.5 'Tag Type Definitions'. The definition of the basic number types used for data encoding and the classes of ASCII codes used are found in clause 5 'Notation, symbols and abbreviations'.

All profile data must be encoded as big-endian.

All color spaces used in this standard shall be in accordance with Annex A : 'Color Spaces'.

6.1 Header Description

The profile header provides the necessary information to allow a receiving system to properly search and sort color data exchange device color profiles. The following Table 7 gives the byte position, content and encoding of the profile header.

This header provides a set of parameters at the beginning of the profile format. For color transformation profiles, the device profile dependent fields are set to zero if irrelevant. Having a fixed length header allows for performance enhancements in the profile searching and sorting operations.

byte(s)	content	Encoded As...
0-3	Profile size	
4-7	Identifies the preferred CMM to be used.	
8-11	Profile version number	see below
12-15	Profile/Device class	
16-19	Color space of data (possibly a derived space) [i.e. "the canonical input space"]	see below
20-23	Profile connection space [i.e. "the canonical output space"]	see below
24-35	Date and time this profile was first created	dateTimeNumber
36-39	'acsp' (0x61637370) profile file signature	
40-43	Primary platform target for the profile	

TABLE 7.

44-47	Flags to indicate various options for the CMM such as distributed processing and caching options	see below
48-51	Device manufacturer of the device for which this profile is created	see below
52-55	Device model of the device for which this profile is created	see below
56-63	Device attributes unique to the particular device setup such as media type	see below
64-67	Specifies the rendering intent of this profile for the CMM. Perceptual, relative colorimetric, saturation and absolute colorimetric are the four intents required to be supported with default values of 0, 1, 2 and 3 respectively.	see below
68-79	The XYZ values of the illuminant of the profile connection space. This must correspond to D50. It is explained in more detail in section 2.	XYZNumber
80-127	48 bytes reserved for future expansion	

TABLE 7.

6.1.1 Profile size:

The total size of the profile as an unsigned long integer.

6.1.2 CMMType

Identifies the preferred CMM to be used. The signatures must be registered in order to avoid conflicts. The Technical Secretary of the International Color Consortium is responsible for the registering of new signatures.

6.1.3 Profile Version

Profile version number where the first 8 bits are the major version number and the next 8 bits are for the minor version number. The major and minor version numbers are set by the International Color Consortium and will match up with the profile format revisions. The current version number is 0x02 with a minor version number of 0x00.

The encoding is such that:

Bytes	content
0	Major Revision in BCD
1	Minor Revision & Bug Fix Revision in each nibble in BCD
2	reserved, must be set to 0
3	reserved, must be set to 0

TABLE 8.

Major version change can only happen if there is an incompatible change. An example of a major version change may be the addition of new required tags. Minor version change can happen with compatible changes. An example of a minor version number change may be the addition of new optional tags.

6.1.4 Profile/Device class

There are three basic classifications (classes) of device profiles: input, display and output profiles.

Within each of these classes there can be a variety of subclasses, such as RGB scanners, CMYK scanners and many others. These basic classes have the following signatures:

signature	description
'scnr'	input devices such as scanners and digital cameras,
'mntr'	display devices such as CRTs and LCDs,
'prtr'	output devices such as printers.

TABLE 9.

In addition to the three basic device profile classes, three additional color processing profiles are defined. These profiles provide a standard implementation for use by the CMM in general color processing or for the convenience of CMMs which may use these types to store calculated transforms. These three profile classes are: device link, color space conversion, and abstract profiles.

Device link profiles provide a mechanism in which to save and store a series of device profiles and non-device profiles in a concatenated format as long as the series begins and ends with a device profile. This is extremely useful for workflow issues where a combination of device profiles and non-device profiles are used repeatedly.

Color space conversion profiles are used as a convenient method for CMMs to convert between different non-device color spaces.

Finally, the abstract color profiles provide a generic method for users to make subjective color changes to images or graphic objects by transforming the color data within the PCS.

These profiles have the following signatures:

signature	description
'link'	device link profiles,
'spac'	color space conversion profiles,
'abst'	abstract profiles.

TABLE 10.

6.1.5 Color Space Signatures

The encoding is such that:

Color Space	Signature	hex encoding
XYZData	'XYZ '	0x58595A20
labData	'Lab '	0x4C616220
luvData	'Luv '	0x4C757620
YCbCrData	'YCbr '	0x59436272
YxyData	'Yxy '	0x59787920
rgbData	'RGB '	0x52474220
grayData	'GRAY'	0x47524159
hsvData	'HSV '	0x48535620
hlsData	'HLS '	0x484C5320
cmykData	'CMYK'	0x434D594B
cmyData	'CMY '	0x434D5920

TABLE 11.

6.1.6 Profile Connection Space Signatures

The encoding is such that:

Profile Connection Color Space	Signature	hex encoding
XYZData	'XYZ '	0x58595A20
labData	'Lab '	0x4C616220

TABLE 12.

When the profile is a DeviceLink profile, the Profile Connection Space Signature is taken from the Color Space Signatures table. (See clause 6.1.5)

6.1.7 Primary Platform Flag

Flags to indicate the primary platform/operating system framework for which the profile was created.

The encoding is such that:

Primary Platform	Signature	hex encoding
Apple Computer, Inc.	'APPL '	0x4150504C
Microsoft Corporation	'MSFT '	0x4D534654
Silicon Graphics, Inc.	'SGI '	0x53474920
Sun Microsystems, Inc.	'SUNW '	0x53554E57
Taligent, Inc.	'TGNT '	0x54474E54

TABLE 13.

6.1.8 ProfileFlags

Flags to indicate various hints for the CMM such as distributed processing and caching options. The first 16 bits (low word in big-endian notation) are reserved for the Profile Consortium.

The encoding is such that:

Flags	Bit Position
Embedded Profile (0 if not embedded, 1 if embedded in file)	0
Profile cannot be used independently from the embedded color data (set to 1 if true, 0 if false)	1

TABLE 14.

6.1.9 Device manufacturer and model:

The signatures for various manufacturers and models are listed in a separate document (ICC Signatures). New signatures must be registered with the ICC.

6.1.10 Attributes

Attributes unique to the particular device setup such as media type. The first 16 bits are reserved for the ICC.

The encoding is such that (with "on" having value 1 and "off" having value 0):

Attribute	bit position
Reflective (off) or Transparency (on)	0
Glossy (off) or Matte (on)	1

TABLE 15.

6.1.11 Rendering Intent:

Perceptual, relative colorimetric, saturation and absolute colorimetric are the four intents required to be supported. The first 16 bits worth of numbers are reserved for the ICC.

The encoding is such that:

Rendering Intent	value
Perceptual	0
Relative Colorimetric	1
Saturation	2
Absolute Colorimetric	3

TABLE 16.

Note that this flag might not have any meaning until the profile is used in some context, e.g. in a DeviceLink or embedded source profile.

6.2 Tag Table Definition

The tag table acts as a table of contents for the tags and tag element data in the profiles. The first four bytes contain a count of the number of tags in the table itself. The tags within the table are not required to be in any particular order.

Individual Tag Structures Within Tag Table

byte(s)	content
0-3	tag signature
4-7	offset to beginning of tag data
8-11	element size for the number of bytes in the tag data element

TABLE 17.

6.2.1 Tag Signatures

A four byte value registered with the ICC technical secretary.

6.2.2 Offset

See clause 4.10 'offset'.

6.2.3 Element Size

Element size for the number of bytes in the tag data element.

6.2.4 Tag Data Requirements

All tag data is required to start on a 4-byte boundary (relative to the start of the profile header) so that a tag starting with a long will be properly aligned without the tag handler needing to know the contents of the tag. This means that the low 2 bits of the beginning offset must be 0. The element size should be for actual data and must not include padding at the end of the tag data.The header is the first element in the file structure encompassing the first 128 bytes. This is immediately followed by the tag table. Tag data elements make up the rest of the file structures. There may be any number of tags and no particular order is required for the data of the tags. Each tag may have any size (up to the limit imposed by the 32 bit offsets). Exactly which tags are required or optional with which profiles have been described in section 3 on Device Profiles.

6.3 Device Profile Requirements

This section provides a top level view of what tags are required for each type of profile classification and a brief description of the algorithmic models associated with these classes. This begins with a subsection describing common tags required of all three device profiles, followed by a general description of each profile class and its required tags. A general description for each tag is included in this section.

Note that these descriptions assume two things; every profile contains a header, and may include additional tags beyond those listed as required in this section. The explicitly listed tags are those which are required in order to comprise a legal profile of each type.

In general, multi-dimensional tables refer to lookup tables with more than one input component.

The intent of requiring tags with profiles is to provide a common base level of functionality. If a custom CMM is not present, then the default CMM will have enough information to perform the requested color transformations. The particular models implied by the required data are also described below. While this data might not provide the highest level of quality obtainable with optional data and private data, the data provided is adequate for sophisticated

device modeling.

Profile	Tag Name	Interpretation
Input Profile	AToB0Tag	none
Display Profile	AToB0Tag	none
Output Profile	BToA0Tag	perceptual rendering
Output Profile	BToA1Tag	colorimetric rendering
Output Profile	BToA2Tag	saturation rendering
Input Profile	grayTRCTag	depends on intent
Display Profile	grayTRCTag	additive
Output Profile	grayTRCTag	subtractive

TABLE 18.

6.3.1 Input Profile

This profile represents input devices such as scanners and digital cameras.

6.3.1.1 Monochrome Input Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
grayTRCTag	Gray tone reproduction curve (TRC)
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 19.

The mathematical model implied by this data is

$linear = redTRC[device]$. This represents a simple tone reproduction curve adequate for most monochrome input devices. The *connection* values in this equation should represent the achromatic channel of the profile connection space. If the inverse of this is desired, then the following equation is used,

$$device = grayTRC^{-1}[connection] .$$

6.3.1.2 RGB Input Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
redColorantTag	Red colorant XYZ relative tristimulus values
greenColorantTag	Green colorant XYZ relative tristimulus values
blueColorantTag	Blue colorant XYZ relative tristimulus values
redTRCTag	Red channel tone reproduction curve
greenTRCTag	Green channel tone reproduction curve
blueTRCTag	Blue channel tone reproduction curve
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 20.

The forward mathematical model implied by this data is:

$$linear_r = redTRC[device_r]$$

$$linear_g = greenTRC[device_g]$$

$$linear_b = blueTRC[device_b]$$

$$\begin{bmatrix} connection_X \\ connection_Y \\ connection_Z \end{bmatrix} = \begin{bmatrix} redColorant_X & greenColorant_X & blueColorant_X \\ redColorant_Y & greenColorant_Y & blueColorant_Y \\ redColorant_Z & greenColorant_Z & blueColorant_Z \end{bmatrix} \begin{bmatrix} linear_r \\ linear_g \\ linear_b \end{bmatrix}$$

This represents a simple linearization followed by a linear mixing model. The three tone reproduction curves linearize the raw values with respect to the luminance (Y) dimension of the CIEXYZ encoding of the profile connection space. The 3x3 matrix converts these linearized values into XYZ values for the CIEXYZ encoding of the profile connection space. The inverse model is given by

the following equation,

$$\begin{bmatrix} linear_r \\ linear_g \\ linear_b \end{bmatrix} = \begin{bmatrix} redColorant_X & greenColorant_X & blueColorant_X \\ redColorant_Y & greenColorant_Y & blueColorant_Y \\ redColorant_Z & greenColorant_Z & blueColorant_Z \end{bmatrix}^{-1} \begin{bmatrix} connection_X \\ connection_Y \\ connection_Z \end{bmatrix}$$

$$device_r = redTRC^{-1}[linear_r]$$

$$device_g = greenTRC^{-1}[linear_g]$$

$$device_b = blueTRC^{-1}[linear_b]$$

Only the CIEXYZ encoding of the profile connection space can be used with matrix/TRC models. A multidimensional table tag must be included if the CIELAB encoding of the profile connection space is to be used.

6.3.1.3 CMYK Input Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
AToB0Tag	Device to PCS: 8 or 16 bit data
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 21.

The AToB0Tag represents a device model described by the Lut8Type or Lut16Types. This tag provides the parameter data for an algorithm that includes a set of non-interdependent per-channel tone reproduction curves, a multi-dimensional lookup table and a set of non-interdependent per-channel linearization curves. The mathematical model implied by this data is described in detail in clauses 6.5.4 and 6.5.5 that specify the general lookup table tag element structures.

This profile type can be used with a printer for space optimized embedding.

6.3.2 Display Profile

This profile represents display devices such as monitors.

6.3.2.1 Monochrome Display Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
grayTRCTag	Gray tone reproduction curve
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 22.

The mathematical model implied by this data is

$$linear = redTRC[device] .$$

This represents a simple tone reproduction curve adequate for most monochrome display devices. The *connection* values in this equation should represent the achromatic channel of the profile connection space. If the inverse of this is desired, then the following equation is used,

$$device = grayTRC^{-1}[connection] .$$

Multidimensional tables are not allowed to be included in monochrome profiles.

6.3.2.2 RGB Display Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
redColorantTag	Relative XYZ values of red phosphor
greenColorantTag	Relative XYZ values of green phosphor
blueColorantTag	Relative XYZ values of blue phosphor
redTRCTag	Red channel tone reproduction curve
greenTRCTag	Green channel tone reproduction curve
blueTRCTag	Blue channel tone reproduction curve
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 23.

This model is based on a three non-interdependent per-channel tone

reproduction curves to convert between linear and non-linear rgb values and a 3x3 matrix to convert between linear rgb values and relative XYZ values. The mathematical model implied by this data is:

$$linear_r = redTRC[device_r]$$
$$linear_g = greenTRC[device_g]$$
$$linear_b = blueTRC[device_b]$$

$$\begin{bmatrix} connection_X \\ connection_Y \\ connection_Z \end{bmatrix} = \begin{bmatrix} redColorant_X & greenColorant_X & blueColorant_X \\ redColorant_Y & greenColorant_Y & blueColorant_Y \\ redColorant_Z & greenColorant_Z & blueColorant_Z \end{bmatrix} \begin{bmatrix} linear_r \\ linear_g \\ linear_b \end{bmatrix}$$

This represents a simple linearization followed by a linear mixing model. The three tone reproduction curves linearize the raw values with respect to the luminance (Y) dimension of the CIEXYZ encoding of the profile connection space. The 3x3 matrix converts these linearized values into XYZ values for the CIEXYZ encoding of the profile connection space. The inverse model is given by the following equation,

$$\begin{bmatrix} linear_r \\ linear_g \\ linear_b \end{bmatrix} = \begin{bmatrix} redColorant_X & greenColorant_X & blueColorant_X \\ redColorant_Y & greenColorant_Y & blueColorant_Y \\ redColorant_Z & greenColorant_Z & blueColorant_Z \end{bmatrix}^{-1} \begin{bmatrix} connection_X \\ connection_Y \\ connection_Z \end{bmatrix}$$

$$device_r = redTRC^{-1}[linear_r]$$
$$device_g = greenTRC^{-1}[linear_g]$$
$$device_b = blueTRC^{-1}[linear_b]$$

Only the CIEXYZ encoding of the profile connection space can be used with matrix/TRC models. A multidimensional table tag must be included if the CIELAB encoding of the profile connection space is to be used.

6.3.3 Output Profile

This profile represents output devices such as printers and film recorders. The LUT tags that are required by the printer profiles contain either the 8 bit or the 16 bit LUTs exclusively as described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'. The LUT algorithm for profile connection space to device space

transformations process data sequentially through a matrix, input tables, a color LUT, and output tables.

6.3.3.1 Monochrome Output Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
grayTRCTag	Gray tone reproduction curve
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 24.

The tone reproduction curve provides the necessary information to convert between a single device channel and the CIEXYZ encoding of the profile connection space.

The mathematical model implied by this data is

$$linear = redTRC[device] .$$

This represents a simple tone reproduction curve adequate for most monochrome output devices. The *connection* values in this equation should represent the achromatic channel of the profile connection space. If the inverse of this is desired, then the following equation is used,

$$device = grayTRC^{-1}[connection] .$$

Multidimensional tables are not allowed to be included in monochrome profiles.

6.3.3.2 RGB and CMYK Output Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
AToB0Tag	Device to PCS: 8 or 16 bit data: intent of 0
BToA0Tag	PCS to Device space: 8 or 16 bit data: intent of 0
gamutTag	Out of Gamut: 8 or 16 bit data
AToB1Tag	Device to PCS: 8 or 16 bit data: intent of 1
BToA1Tag	PCS to Device space: 8 or 16 bit data: intent of 1
AToB2Tag	Device to PCS: 8 or 16 bit data: intent of 2
BToA2Tag	PCS to Device space: 8 or 16 bit data: intent of 2
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 25.

These tags represent a device model described in clause 6.5.5 'lut8Type' or clause 6.5.4 'lut16Type'. The intent values described in these tags directly correlate to the value of the rendering intent header flag of the source profile in the color modeling session.

Rendering Intent	Value
perceptual	0
relative colorimetric	1
saturation	2
absolute colorimetric	3

TABLE 26.

Each of the first three intents are associated with a specific tag. The fourth intent, absolute colorimetry, is obtained by modifying the relative colorimetric intent tag based on the values which are in the mediaWhitePointTag. It is permissible to reference the same tag for all of these intents and to use the relative colorimetric intent tag when absolute colorimetry is specified. This decision is left to the profile builder.

In essence, each of these tags provides the parameter data for an algorithm that includes a 3x3 matrix, a set of non-interdependent per-channel tone reproduction curves, a multidimensional lookup table and a set of non-interdependent per-channel linearization curves. The algorithmic details of this model and the intent of each tag is given later in clauses 6.5.4 'lut16Type' or 6.5.5

'lut8Type' that specify the general lookup table tag element structures.

This profile represents output devices such as printers and film recorders. The LUT tags that are required by the printer profiles contain either the 8 bit or the 16 bit LUTs as described in the LUT tags. The LUT algorithm for profile connection space to device space transformations process data sequentially through a matrix, input tables, a color LUT, and output tables.

6.3.4 Additional Profile Formats

6.3.4.1 DeviceLink Profile

This profile represents a one-way link or connection between devices. It does not represent any device model nor can it be embedded into images.

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
AToB0Tag	Actual transformation parameter structure (this is an exclusive or) 8 or 16 bit data
profileSequence-DescTag	An array of descriptions of the profile sequence
copyrightTag	7 bit ASCII profile copyright information

TABLE 27.

The single AToB0Tag may contain any of the four possible rendering intents. The rendering intent used is indicated in the header of the profile.

The AToB0Tag represents a device model described in clause 6.5.4 'lut16Type' or clause 6.5.5 'lut8Type'. This tag provides the parameter data for an algorithm that includes a 3x3 matrix, a set of non-interdependent per-channel tone reproduction curves, a multidimensional lookup table and a set of non-interdependent per-channel linearization curves. The algorithmic details of this model and the intent of each tag is given later in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type' that specify the general lookup table tag element structures. This is a pre-evaluated transform that cannot be undone.

The color space of data in the DeviceLink profile will be the same as the color space of the data of the first profile in the sequence. The profile connection space will be the same as the color space of the data of the last profile in the sequence.

6.3.4.2 ColorSpaceConversion Profile

This profile provides the relevant information to perform a color space transformation between the non-device color spaces and the PCS. It does not represent any device model.

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
BToA0Tag	Inverse transformation parameter structure (this is an exclusive or) 8 or 16 bit data
AToB0Tag	Actual transformation parameter structure (this is an exclusive or) 8 or 16 bit data
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 28.

The AToB0Tag and BToA0Tag represent a model described in clause 6.5.4 'lut16Type' or clause 6.5.5 'lut8Type'. This tag provides the parameter data for an algorithm that includes a 3x3 matrix, a set of non-interdependent per-channel tone reproduction curves, a multidimensional lookup table and a set of non-interdependent per-channel linearization curves. The algorithmic details of this model and the intent of each tag is given later in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type' that specify the general lookup table tag element structures.

For color transformation profiles, the device profile dependent fields are set to zero if irrelevant.

6.3.4.3 Abstract Profile

This profile represents abstract transforms and does not represent any device model. Color transformations using abstract profiles are performed from PCS to

PCS.

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
AToB0Tag	Actual transformation parameter structure (this is an exclusive or) 8 or 16 bit data
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 29.

The AToB0Tag represents a PCS to PCS model described by the Lut8Type or Lut16Types. This tag provides the parameter data for an algorithm that includes a 3x3 matrix, a set of non-interdependent per-channel tone reproduction curves, a multidimensional lookup table and a set of non-interdependent per-channel linearization curves. The algorithmic details of this model and the intent of each tag is given later in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type' that specify the general lookup table tag element structures.

6.4 Tag Descriptions

This section specifies the individual tags used to create all possible portable profiles in the ICC Profile Format. The appropriate tag typing is indicated with each individual tag description. Note that the signature indicates only the type of data and does not imply anything about the use or purpose for which the data is intended.

In addition to the tags listed below, any of the previously defined tags in clause 6.3 'Device Profile Requirements' can also be used as optional tags if they are not used in the required set for a particular profile.

Tag Name	General Description
AToB0Tag	Multidimensional transformation structure
AToB1Tag	Multidimensional transformation structure
AToB2Tag	Multidimensional transformation structure
blueColorantTag	Relative XYZ values of blue phosphor or colorant
blueTRCTag	Blue channel tone reproduction curve
BToA0Tag	Multidimensional transformation structure
BToA1Tag	Multidimensional transformation structure

TABLE 30.

BToA2Tag	Multidimensional transformation structure
calibrationDateTimeTag	Profile calibration date and time
charTargetTag	Characterization target such as IT8/7.2
copyrightTag	7 bit ASCII profile copyright information
deviceMfgDescTag	displayable description of device manufacturer
deviceModelDescTag	displayable description of device model
gamutTag	Out of Gamut: 8 or 16 bit data
grayTRCTag	Gray tone reproduction curve
greenColorantTag	Relative XYZ values of green phosphor or colorant
greenTRCTag	Green channel tone reproduction curve
luminanceTag	Absolute luminance for emissive device
measurementTag	Alternative measurement specification information
mediaBlackPointTag	Media XYZ black point
mediaWhitePointTag	Media XYZ white point
namedColorTag	Dictionary for converting between named colors and interchange or device color spaces
preview0Tag	Preview transformation: 8 or 16 bit data
preview1Tag	Preview transformation: 8 or 16 bit data
preview2Tag	Preview transformation: 8 or 16 bit data
profileDescriptionTag	profile description for display
profileSequenceDescTag	profile sequence from source to destination
ps2CRD0Tag	PostScript Level 2 color rendering dictionary: perceptual
ps2CRD1Tag	PostScript Level 2 color rendering dictionary: colorimetric
ps2CRD2Tag	PostScript Level 2 color rendering dictionary: saturation
ps2CRD3Tag	PostScript Level 2 color rendering dictionary: absolute
ps2CSATag	PostScript Level 2 color space array
ps2RenderingIntentTag	PostScript Level 2 Rendering Intent
redColorantTag	Relative XYZ values of red phosphor or colorant
redTRCTag	Red channel tone reproduction curve

TABLE 30.

screeningDescTag	Screening attributes description
screeningTag	Screening attributes such as frequency, angle and spot
technologyTag	Device technology information such as LCD, CRT, Dye Sublimation, etc.
ucrbgTag	Under color removal curve
viewingCondDescTag	Specifies viewing condition description
viewingConditionsTag	Specifies viewing condition parameters

TABLE 30.

6.4.1 AToB0Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'A2B0' 0x41324230

Device to PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.2 AToB1Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'A2B1' 0x41324231

Device to PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.3 AToB2Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : T'A2B2' 0x41324232

Device to PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.4 blueColorantTag

Tag Type : XYZType
Tag Signature : 'bXYZ' 0x6258595A

The relative XYZ values of blue phosphor or colorant.

6.4.5 blueTRCTag

Tag Type : curveType
Tag Signature : 'bTRC' 0x62545243

Blue channel tone reproduction curve. The first element represents no colorant (white) or phosphors (black) and the last element represents 100 percent colorant (blue) or 100 percent phosphor (blue).

The count value specifies the number of entries in the curve table except as follows:

when count is 0, then a linear response (slope equal to 1.0) is assumed,

when count is 1, then the data entry is interpreted as a simple gamma value ranging from 0 to 8 in fixed unsigned 8.8 format).

Gamma is interpreted canonically and NOT as an inverse.

6.4.6 BToA0Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'B2A0' 0x42324130

PCS to Device space: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.7 BToA1Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'B2A1' 0x42324131

PCS to Device space: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.8 BToA2Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'B2A2' 0x42324132

PCS to Device space: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.9 calibrationDateTimeTag

Tag Type : dateTimeType
Tag Signature : 'calt' 0x63616C74

Profile calibration date and time. Initially, this tag matches the contents of the creationDateTime header flag. This allows applications and utilities to verify if this profile matches a vendor's profile and how recently calibration has been performed.

6.4.10 charTargetTag

Tag Type : textType
Tag Signature : 'targ' 0x74617267

This tag contains the measurement data for a characterization target such as IT8.7/2. This tag is provided so that distributed utilities can create transforms "on the fly" or check the current performance against the original device performance. The tag embeds the exact data file format defined in the ANSI or ISO standard which is applicable to the device being characterized.

Examples are the data formats described in ANSI IT8.7/1-1993 section 4.10, ANSI IT8.7/2-1993 section 4.10 and ANSI IT8.7/3 section 4.10. Each of these file formats contains an identifying character string as the first few bytes of the format, allowing an external parser to determine which data file format is being used. This provides the facilities to include a wide range of targets using a variety of measurement specifications in a standard manner.

> Note: The IT8 specifications do not currently have a keyword which identifies the set as being reference data as opposed to device response data. An addition to enable this additional data set is being considered by the IT8 committee.

6.4.11 copyrightTag

Tag Type : textType
Tag Signature : 'cprt' 0x63707274

This tag contains the 7 bit ASCII text copyright information for the profile.

6.4.12 deviceMfgDescTag

Tag Type : textDescriptionType
Tag Signature : 'dmnd' 0x646D6E64

Structure containing invariant and localizable versions of the device manufacturer for display. The content of this structure is described in clause 6.5.9 'textDescriptionType'.

6.4.13 deviceModelDescTag

Tag Type : textDescriptionType
Tag Signature : 'dmdd' 0x646D6464

Structure containing invariant and localizable versions of the device model for display. The content of this structure is described in clause 6.5.9 'textDescriptionType'.

6.4.14 gamutTag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'gamt' 0x67616D74

Out of Gamut tag: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

The CLUT tag has a single output. If the output value is 0, the input color is in gamut. If the output is non-zero, the input color is out of gamut, with the number "n+1" being at least at far out of the gamut as the number "n".

6.4.15 grayTRCTag

Tag Type : curveType
Tag Signature : 'kTRC' 0x6B545243

Gray tone reproduction curve. The tone reproduction curve provides the necessary information to convert between a single device channel and the CIEXYZ encoding of the profile connection space. The first element represents no colorant (white) or phosphors (black) and the last element represents 100 percent colorant (black) or 100 percent phosphor (white).

The count value specifies the number of entries in the curve table except as follows:

when count is 0, then a linear response (slope equal to 1.0) is assumed,

when count is 1, then the data entry is interpreted as a simple gamma value ranging from 0 to 8 in fixed unsigned 8.8 format).

Gamma is interpreted canonically and NOT as an inverse.

...4.16 greenColorantTag

...ag Type : XYZType
...ag Signature : 'gXYZ' 0x6758595A

...elative XYZ values of green phosphor or colorant.

...4.17 greenTRCTag

...ag Type : curveType
...ag Signature : 'gTRC' 0x67545243

...reen channel tone reproduction curve. The first element represents no ...olorant (white) or phosphors (black) and the last element represents 100 percent ...olorant (green) or 100 percent phosphor (green).

The count value specifies the number of entries in the curve table except ...as follows:

when count is 0, then a linear response (slope equal to 1.0) is assumed,

when count is 1, then the data entry is interpreted as a simple gamma value ranging from 0 to 8 in fixed unsigned 8.8 format).

Gamma is interpreted canonically and NOT as an inverse.

...4.18 luminanceTag

...g Type : XYZType
...ag Signature : 'lumi' 0x6C756D69

...bsolute luminance of devices is in candelas per meter squared as described by ...e Y channel. The X and Z channels are ignored in all cases.

...19 measurementTag

...g Type : measurementType
...g Signature : 'meas' 0x6D656173

...ernative measurement specification such as a D65 illuminant instead of the ...fault D50.

...20 mediaBlackPointTag

...g Type : XYZType

Tag Signature : 'bkpt' 0x626b7074

This tag specifies the media black point and is used for generating absolute colorimetry. It is referenced to the profile connection space so that the media black point as represented in the PCS is equivalent to this tag value. If this tag is not present, it is assumed to be (0,0,0).

6.4.21 mediaWhitePointTag

Tag Type : XYZType
Tag Signature : 'wtpt' 0x77747074

This tag specifies the media white point and is used for generating absolute colorimetry. It is referenced to the profile connection space so that the media white point as represented in the PCS is equivalent to this tag value.

6.4.22 namedColorTag

Tag Type : namedColorType
Tag Signature : 'ncol' 0x6E636F6C

Named color reference transformation for converting between named color sets and the profile connection space or device color spaces.

6.4.23 preview0Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'pre0' 0x70726530

Preview transformation from PCS to device space and back to the PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.24 preview1Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'pre1' 0x70726531

Preview transformation from the PCS to device space and back to the PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.25 preview2Tag

Tag Type : lut8Type xor lut16Type

Tag Signature : 'pre2' 0x70726532

Preview transformation from PCS to device space and back to the PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.26 profileDescriptionTag

Tag Type : textDescriptionType
Tag Signature : 'desc' 0x64657363

Structure containing invariant and localizable versions of the profile description for display. This content of this structure is described in clause 6.5.9 'textDescriptionType'. This invariant description has no fixed relationship to the actual profile disk file name.

6.4.27 profileSequenceDescTag

Tag Type : profileSequenceDescType
Tag Signature : 'pseq' 0x70736571

Structure containing a description of the profile sequence from source to destination, typically used with the devicelink profile. This content of this structure is described in clause 6.5.8 'profileSequenceDescType'.

6.4.28 ps2CRD0Tag

Tag Type : dataType
Tag Signature : 'psd0' 0x70736430

PostScript Level 2 Type 1 color rendering dictionary (CRD) for the Perceptual rendering intent. This tag provides the dictionary operand to the setcolorrendering operator. This tag can be used in conjunction with the setcolorrendering operator on any PostScript Level 2 device.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.29 ps2CRD1Tag

Tag Type : dataType
Tag Signature : 'psd1' 0x70736431

PostScript Level 2 Type 1 CRD for the RelativeColorimetric rendering intent. This tag provides the dictionary operand to the setcolorrendering operator. This

tag can be used in conjunction with the setcolorrendering operator on any PostScript Level 2 device.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.30 ps2CRD2Tag

Tag Type : dataType
Tag Signature : 'psd2' 0x70736432

PostScript Level 2 Type 1 CRD for the Saturation rendering intent. This tag provides the dictionary operand to the setcolorrendering operator. This tag can be used in conjunction with the setcolorrendering operator on any PostScript Level 2 device.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.31 ps2CRD3Tag

Tag Type : dataType
Tag Signature : 'psd3' 0x70736433

PostScript Level 2 Type 1 CRD for the AbsoluteColorimetric rendering intent. This tag provides the dictionary operand to the setcolorrendering operator. This tag can be used in conjunction with the setcolorrendering operator on any PostScript Level 2 device.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.32 ps2CSATag

Tag Type : dataType
Tag Signature : 'ps2s' 0x70733273

PostScript Level 2 color space array. This tag provides the array operand to the setcolorspace operator. For color spaces that fit within the original PostScript Level 2 device independent color model no operator verification need be performed. For color spaces that fit only within extensions to this model, operator verification is first required. An example of this would be for Calibrated CMYK input color spaces which are supported via an extension. In such cases where the necessary PostScript Level 2 support is not available, PostScript Level 1 color spaces, such as DeviceCMYK, can be used, or the colors

can be converted on the host using a CMS. In the latter case, the PostScript Level 1 color operators are used to specify the device dependent (pre-converted) colors. The PostScript contained in this tag expects the associated color values instantiated either through setcolor or image to be in the range [0, 1].

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.33 ps2RenderingIntentTag

Tag Type : dataType
Tag Signature : 'ps2i' 0x70733269

PostScript Level 2 rendering intent. This tag provides the operand to the findcolorrendering operator. findcolorrendering is not necessarily supported on all PostScript Level 2 devices, hence its existence must first be established. Standard values for ps2RenderingIntentTag are RelativeColorimetric, AbsoluteColorimetric, Perceptual, and Saturation. These intents are meant to correspond to the rendering intents of the profile's header.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.34 redColorantTag

Tag Type : XYZType
Tag Signature : 'rXYZ' 0x7258595A

Relative XYZ values of red phosphor or colorant.

6.4.35 redTRCTag

Tag Type : curveType
Tag Signature : 'rTRC' 0x72545243

Red channel tone reproduction curve. The first element represents no colorant (white) or phosphors (black) and the last element represents 100 percent colorant (red) or 100 percent phosphor (red).

The count value specifies the number of entries in the curve table except as follows:

when count is 0, then a linear response (slope equal to 1.0) is assumed,

when count is 1, then the data entry is interpreted as a simple gamma

value ranging from 0 to 8 in fixed unsigned 8.8 format).

Gamma is interpreted canonically and NOT as an inverse.

6.4.36 screeningDescTag

Tag Type : textDescriptionType
Tag Signature : 'scrd' 0x73637264

Structure containing invariant and localizable versions of the screening conditions. This content of this structure is described in clause 6.5.9 'textDescriptionType'.

6.4.37 screeningTag

Tag Type : screeningType
Tag Signature : 'scrn' 0x7363726E

This tag contains screening information for a variable number of channels.

6.4.38 technologyTag

Tag Type : signatureType
Tag Signature : 'tech' 0x74656368

Device technology information such as CRT, Dye Sublimation, etc. If this tag is not used

The encoding is such that:

Technology	signature	hex signature
Film Scanner	'fscn'	0x6673636E
Digital Camera	'dcam'	0x6463616D
Reflective Scanner	'rscn'	0x7273636E
Ink Jet Printer	'ijet'	0x696A6574
Thermal Wax Printer	'twax'	0x74776178
Electrophotographic Printer	'epho'	0x6570686F
Electrostatic Printer	'esta'	0x65737461
Dye Sublimation Printer	'dsub'	0x64737562
Photographic Paper Printer	'rpho'	0x7270686F
Film Writer	'fprn'	0x6670726E

TABLE 31.

Video Monitor	'vidm'	0x7669646D
Video Camera	'vidc'	0x76696463
Projection Television	'pjtv'	0x706A7476
Cathode Ray Tube Display	'CRT '	0x43525420
Passive Matrix Display	'PMD '	0x504D4420
Active Matrix Display	'AMD '	0x414D4420
Photo CD	'KPCD'	0x4B504344
PhotoImageSetter	'imgs'	0x696D6773
Gravure	'grav'	0x67726176
Offset Lithography	'offs'	0x6F666673
Silkscreen	'silk'	0x73696C6B
Flexography	'flex'	0x666C6578

TABLE 31.

6.4.39 ucrbgTag

Tag Type : ucrbgType
Tag Signature : 'bfd ' 0x62666420

Under color removal and black generation specification. This tag contains curve information for both under color removal and black generation in addition to a general description. This content of this structure is described in clause 6.5.15 'ucrbgType'.

6.4.40 viewingCondDescTag

Tag Type : Tag Type: textDescriptionType
Tag Signature : 'vued' 0x76756564

Structure containing invariant and localizable versions of the viewing conditions. This content of this structure is described in clause 6.5.9 'textDescriptionType'.

6.4.41 viewingConditionsTag

Tag Type : viewingConditionsType
Tag Signature : 'view' 0x76696577

Viewing conditions parameters.

6.5 Tag Type Definitions

This section specifies the type and structure definitions used to create all of the individual tagged elements in ICC Profile Format. The data type description identifiers are indicated at the right margin of each data or structure definition. An effort was made to make sure one-byte, two-byte and four-byte data lies on one-byte, two-byte and four-byte boundaries respectively, this required occasionally including extra spaces indicated with "reserved for padding" in some tag type definitions. Value 0 is defined to be of "unknown value" for all enumerated data structures.

All tags, including private tags, have as their first four bytes (0-3) a tag signature (a 4 byte character sequence) to identify to profile readers what kind of data is contained within a tag. This encourages tag type reuse and allows profile parsers to reuse code when tags use common tag types. The second four bytes (4-7) are reserved for future expansion and must be set to 0 in this version of the specification. Each new tag signature and tag type signature must be registered with the International Color Consortium in order to prevent signature collisions.

Where not specified otherwise, the low 16 bits of all 32 bit flags in the type descriptions below are reserved for use by the International Color Consortium.

When 7 bit ASCII text representation is specified in types below, each individual character is encoded in 8 bits with the high bit set to zero. The details are presented in Appendix C.

6.5.1 curveType

The curveType contains a 4 byte count value and a one-dimensional table of 2 byte values. The byte stream is given below.

byte(s)	content
0-3	'curv'(0x63757276) type descriptor
4-7	reserved, must be set to 0
8-11	count value specifying number of entries that follow
12-end	actual curve values starting with the zeroth entry and ending with the entry count-1.

TABLE 32.

Unless otherwise specified (see clauses 6.4.5 'blueTRCTag', 6.4.15 'grayTRCTag', 6.4.17 'greenTRCTag',and 6.4.35 'redTRCTag') curve values are in the range [0.0, 1.0]. These 16 bit unsigned integers in the range 0 to (2^16)-1

(65535) linearly map to curve values in the interval [0.0, 1.0].

6.5.2 dataType

The dataType is a simple data containing structure that contains either 7 bit ASCII or binary data, i.e. textType data or transparent 8-bit bytes. The length of the string can easily be obtained from the element size portion of the tag itself. If this type is used for ASCII data, it must be terminated with a 0x00 byte.

byte(s)	content
0-3	'data'(0x64617461) type descriptor
4-7	reserved, must be set to 0
8-11	data flag, 0x00000000 represents ASCII data, 0x00000001 represents binary data, other values are reserved for future use
12-n	a string of count ASCII characters or count bytes (where count is derived from the element size portion of the tag itself)

TABLE 33.

6.5.3 dateTimeType

This dateTimeType is a 12 byte value representation of the time and date. The actual values are encoded as a dateTimeNumber described in clause 5.2.1.

byte(s)	content	Encoded As...
0-3	'dtim'(0x6474696D) type descriptor	
4-7	reserved, must be set to 0	
8-19	date and time	dateTimeNumber

TABLE 34.

6.5.4 lut16Type

This structure converts an input color into an output color using tables with 16 bit precision. This type contains four processing elements: a 3 by 3 matrix (only used when the input color space has three components), a set of one dimensional input lookup tables, a multidimensional lookup table, and a set of one dimensional output tables. Data is processed using these elements via the following sequence:

(matrix) -> (1d input tables) -> (multidimensional lookup table) -> (1d output tables).

byte(s)	content	Encoded As...
0-3	'mft2'(0x6D667432) [multi-function table with 2 byte precision] type descriptor	
4-7	reserved, must be set to 0	
8	Number of Input Channels	uInt8Number
9	Number of Output Channels	uInt8Number
10	Number of CLUT grid points (identical for each side)	uInt8Number
11	Reserved for padding (required to be 0x00)	
12-15	Encoded e00 parameter	s15Fixed16Number
16-19	Encoded e01 parameter	s15Fixed16Number
20-23	Encoded e02 parameter	s15Fixed16Number
24-27	Encoded e10 parameter	s15Fixed16Number
28-31	Encoded e11 parameter	s15Fixed16Number
32-35	Encoded e12 parameter	s15Fixed16Number
36-39	Encoded e20 parameter	s15Fixed16Number
40-43	Encoded e21 parameter	s15Fixed16Number
44-47	Encoded e22 parameter	s15Fixed16Number
48-49	Number of input table entries	uInt16Number
50-51	Number of output table entries	uInt16Number
52-n	input tables	
n+1-m	CLUT values	
m+1-o	output tables	

TABLE 35.

The input, output and CLUT tables are arrays of 16 bit unsigned values. Each input table consists of up to 4096 two byte integers. Each input table entry is appropriately normalized to the range 0-(65535 - 256). This range was chosen to allow for convenient computations. The inputTable is of size InputChannels * inputTableEntries * 2 bytes. When stored in this tag, the one-dimensional lookup tables are assumed to be packed one after another in the order described below.

The matrix is organized as an 3 by 3 array. The dimension corresponding to the matrix rows varies least rapidly and the dimension corresponding to the matrix columns varies most rapidly and is shown in matrix form below. Each

matrix entry is a four byte number with one sign bit, 15 integer bits, and 16 fractional bits.

$$\begin{bmatrix} e00 & e01 & e02 \\ d10 & e11 & e12 \\ e20 & e21 & e22 \end{bmatrix}$$

When using the matrix of an output profile, and the input data is XYZ, we have

$$\begin{bmatrix} X' \\ Y' \\ Z' \end{bmatrix} = \begin{bmatrix} XX & XY & XZ \\ YX & YY & YZ \\ ZX & ZY & ZZ \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

Each input X, Y or Z is an unsigned 1.15 number and each matrix entry is a signed 15.16 number. Therefore, each multiplication in the matrix multiply is 1.15 * s15.16 = s16.31 and the final sum is also s16.31. From this sum we take bits 31-16 as the unsigned integer result for X', Y', or Z'. These are then used as the inputs to the input tables of the multidimensional LUT. This normalization is used since the number of fractional bits in the input data must be maintained by the matrix operation.

The matrix is mandated to be an identity matrix unless the input is in the XYZ color space.

Each CLUT is organized as an n-dimensional array with a given number of grid points in each dimension, where n is the number of input channels (input tables) in the transform. The dimension corresponding to the first input channel varies least rapidly and the dimension corresponding to the last input channel varies most rapidly. Each grid point value contains m two byte integers, where m is the number of output functions. The first sequential two byte integer of the entry contains the function value for the first output function, the second sequential two byte integer of the entry contains the function value for the second output function, and so on until all the output functions have been supplied. The equation for computing the size of the CLUT is:

$$CLUTSize = LUTDimensions^{InputChannels} \bullet OutputChannels \bullet 2Bytes$$

Each output table consists of a minimum of two and a maximum of 4096

two byte integers. The outputTable is of size OutputChannels * outputTableEntries * 2 bytes. When stored in this tag, the one-dimensional lookup tables are assumed to be packed one after another in the order described in the following paragraph.

When using this type, it is necessary to assign each color space component to an input and output channel. The following table shows these assignments. The channels are numbered according to the order in which their table occurs. Note that additional color spaces can be added simply by defining the signature, channel assignments, and creating the tables.

Color Space	Channel 1	Channel 2	Channel 3	Channel 4
'XYZ'	X	Y	Z	
'Lab'	L	a	b	
'Luv'	L	u	v	
'YCbr'	Y	Cb	Cr	
'Yxy'	Y	x	y	
'RGB'	R	G	B	
'GRAY'	K			
'HSV'	H	S	V	
'HLS'	H	L	S	
'CMYK'	C	M	Y	K
'CMY'	C	M	Y	

TABLE 36.

6.5.5 lut8Type

This structure converts an input color into an output color using tables of 8 bit precision. This type contains four processing elements: a 3 by 3 matrix (only used when the input color space has three components), a set of one dimensional input lookup tables, a multidimensional lookup table, and a set of one dimensional output tables. Data is processed using these elements via the following sequence:

(matrix) -> (1d input tables) -> (multidimensional lookup table) -> (1d output tables).

byte(s)	content	Encoded As...
0-3	'mft1'(0x6D667431) [multi-function table with 1 byte precision] type descriptor	
4-7	reserved, must be set to 0	
8	Number of Input Channels	uInt8Number
9	Number of Output Channels	uInt8Number
10	Number of CLUT grid points (identical for each side)	uInt8Number
11	Reserved for padding (fill with 0x00)	
12-15	Encoded e00 parameter	s15Fixed16Number
16-19	Encoded e01 parameter	s15Fixed16Number
20-23	Encoded e02 parameter	s15Fixed16Number
24-27	Encoded e10 parameter	s15Fixed16Number
28-31	Encoded e11 parameter	s15Fixed16Number
32-35	Encoded e12 parameter	s15Fixed16Number
36-39	Encoded e20 parameter	s15Fixed16Number
40-43	Encoded e21 parameter	s15Fixed16Number
44-47	Encoded e22 parameter	s15Fixed16Number
48-m	input tables	
m+1-n	CLUT values	
n+1-o	output tables	

TABLE 37.

The input, output and CLUT tables are arrays of 8 bit unsigned values. Each input table consists of 256 one byte integers. Each input table entry is appropriately normalized to the range 0-255. The inputTable is of size InputChannels * 256 bytes. When stored in this tag, the one-dimensional lookup tables are assumed to be packed one after another in the order described below.

The matrix is organized as a 3 by 3 array. The dimension corresponding to the matrix rows varies least rapidly and the dimension corresponding to the matrix columns varies most rapidly and is shown in matrix form below.

$$\begin{bmatrix} e00 & e01 & e02 \\ d10 & e11 & e12 \\ e20 & e21 & e22 \end{bmatrix}$$

When using the matrix of an output profile, and the input data is XYZ, we have

$$\begin{bmatrix} X' \\ Y' \\ Z' \end{bmatrix} = \begin{bmatrix} XX & XY & XZ \\ YX & YY & YZ \\ ZX & ZY & ZZ \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

Each input X, Y or Z is an unsigned 1.15 number and each matrix entry is a signed 15.16 number. Therefore, each multiplication in the matrix multiply is 1.15 * s15.16 = s16.31 and the final sum is also s16.31. From this sum we take bits 31-16 as the unsigned integer result for X', Y', or Z'. These are then scaled to the range 0-255 and used as the inputs to the input tables of the multidimensional LUT. This normalization is used since the number of fractional bits in the input data must be maintained by the matrix operation.

The matrix is mandated to be an identity matrix unless the input is in the XYZ color space.

Each CLUT is organized as an n-dimensional array with a variable number of grid points in each dimension, where n is the number of input channels (input tables) in the transform. The dimension corresponding to the first input channel varies least rapidly and the dimension corresponding to the last input channel varies most rapidly. Each grid point value is an m-byte array. The first sequential byte of the entry contains the function value for the first output function, the second sequential byte of the entry contains the function value for the second output function, and so on until all the output functions have been supplied. The equation for computing the size of the CLUT is:

$$CLUTSize = LUTDimensions^{InputChannels} \bullet OutputChannels \bullet Bytes$$

Each output table consists of 256 one byte integers. The outputTable is of size OutputChannels * 256 bytes. When stored in this tag, the one-dimensional lookup tables are assumed to be packed one after another in the order described

in the following paragraph.

When using this type, it is necessary to assign each color space component to an input and output channel. The following table shows these assignments. The channels are numbered according to the order in which their table occurs. Note that additional color spaces can be added simply by defining the signature, channel assignments, and creating the tables.

Color Space	Channel 1	Channel 2	Channel 3	Channel 4
'XYZ'	X	Y	Z	
'Lab'	L	a	b	
'Luv'	L	u	v	
'Yxy'	Y	x	y	
'YCbr'	Y	Cb	Cr	
'RGB'	R	G	B	
'GRAY'	K			
'HSV'	H	S	V	
'HLS'	H	L	S	
'CMYK'	C	M	Y	K
'CMY'	C	M	Y	

TABLE 38.

6.5.6 measurementType

The measurementType information refers only to the internal profile data and is meant to provide profile makers an alternative to the default measurement specifications.

byte(s)	content	Encoded As...
0-3	'meas'(0x6D656173) type descriptor	
4-7	reserved, must be set to 0	
8-11	encoded value for standard observer	see below
12-23	XYZ tristimulus values for measurement backing	XYZNumber
24-27	encoded value for measurement geometry	see below
28-31	encoded value for measurement flare	see below
32-35	encoded value for standard illuminant	see below

TABLE 39.

The encoding for the standard observer field is such that:

Standard Observer	Encoded Value
unknown	0x00000000
1931 2 Observer	0x00000001
1964 10 Observer	0x00000002

TABLE 40.

The encoding for the measurement geometry field is such that:

Geometry	Encoded Value
unknown	0x00000000
0/45 or 45/0	0x00000001
0/d or d/0	0x00000002

TABLE 41.

The encoding for the measurement flare value is shown below and is equivalent to the basic numeric type u16Fixed16Number in sub-clause 5.2.3.

Tristimulus Value	Encoded Value
0 (0%)	0x00000000
1.0 (or 100%)	0x00010000

TABLE 42.

The encoding for the standard illuminant field is such that:

Standard Illuminant	Encoded Value
unknown	0x00000000
D50	0x00000001
D65	0x00000002
D93	0x00000003
F2	0x00000004
D55	0x00000005
A	0x00000006
Equi-Power (E)	0x00000007
F8	0x00000008

TABLE 43.

6.5.7 namedColorType

This namedColorType is a count value and array of structures that provide color coordinates for 7 bit ASCII color names. This provides users the ability to create a logo color dictionary between a named color set and a space color specification. The color space is identified by the "color space of data" field of the profile header. In order to maintain maximum portability it is strongly recommended that special characters of the 7 bit ASCII set not be used.

byte(s)	content	Encoded As...
0-3	'ncol'(0x6E636F6C) type descriptor	
4-7	reserved, must be set to 0	
8-11	vender specific flag (lower 16 bits reserved for Consortium use)	
12-15	count of named colors	uInt32Number
15-t	prefix for each color name (maximum of 32 bytes) 7 bit ASCII, 0 terminated	
t+1-u	suffix for each color name (maximum of 32 bytes) 7 bit ASCII, 0 terminated	
u+1-v	first color root name (maximum of 32 bytes) 7 bit ASCII, 0 terminated	
v+1-w	first name's color coordinates. Color space of data	
w+1-x	second color root name (maximum of 32 bytes) 7 bit ASCII, 0 terminated	
x+1-y	second name's color coordinates. Color space of data	
y+1-z	the remaining count-2 name structures as described in the first two name structures (assuming count > 2)	

TABLE 44.

6.5.8 profileSequenceDescType

This type is an array of structures, each of which contains information from the header fields and tags from the original profiles which were combined to create the final profile. The order of the structures is the order in which the profiles were combined and includes a structure for the final profile. This provides a description of the profile sequence from source to destination, typically used

with the devicelink profile.

byte(s)	content
0-3	'pseq'(0x70736571) type descriptor
4-7	reserved, must be set to 0
8-11	count value specifying number of description structures in the array
12-m	'count' profile description structures

TABLE 45.

Each profile description structure has the format:

byte(s)	content
0-3	Device manufacturer signature (from corresponding profile's header)
4-7	Device model signature (from corresponding profile's header)
8-15	Device attributes (from corresponding profile's header)
16-19	Device technology information such as CRT, Dye Sublimation, etc. (corresponding profile's technology signature)
20-m	displayable description of device manufacturer (corresponding profile's deviceMfgDescTag)
m+1- n	displayable description of device model (corresponding profile's deviceMfgDescTag)

TABLE 46.

If the deviceMfgDescTag and/or deviceModelDescTag is not present in a component profile, then a "placeholder" tag should be inserted. This tag should have a 1 in the ASCII count field and a terminating null in the ASCII invariant profile description and zeros in the UniCode and ScriptCode count and code fields.

If the technologyTag is not present, bytes 16-19 should be filled in as zeros.

Also note that the entire tag, including the tag type, should be stored.

6.5.9 textDescriptionType

The textDescriptionType is a complex structure that contains three types of text description structures: 7 bit ASCII, Unicode and ScriptCode. Since no single standard method for specifying localizable character sets exists across the major

platform vendors, including all three provides access for the major operating systems. The 7 bit ASCII description is to be an invariant, nonlocalizable name for consistent reference. It is preferred that both the Unicode and ScriptCode structures be properly localized.

The localized Macintosh profile description contains 67 bytes of data, of which at most 'count' bytes contain a ScriptCode string, including a null terminator. The 'count' cannot be greater than 67.

The count field for each types are defined as follows:

ASCII: The count is the length of the string in bytes including the null terminator.

Unicode: The count is the number of characters including a Unicode null where a character is always two bytes.

ScriptCode: The count is the length of the string in bytes including the terminating null.

If both Unicode and ScriptCode structures cannot be localized, then the following guidelines should be used. If Unicode is not native on the platform, then the Unicode should be filled in as 0 and ASCII data inserted in the text field. If the ScriptCode is not native on the platform, then the ScriptCode should be filled in as 0 and the ASCII data inserted in the text field.

byte(s)	content
0-3	'desc'(0x64657363) type descriptor
4-7	reserved, must be set to 0
8-11	7 bit ASCII invariant Profile description count, including terminating null (description length)
12-n-1	7 bit ASCII invariant Profile description
n-n+3	Unicode language code
n+4-n+7	Unicode localizable Profile description count (description length)
n+8-m-1	Unicode localizable Profile description
m-m+1	ScriptCode code
m+2	Localizable Macintosh Profile description count (description length)
m+3-m+69	Localizable Macintosh Profile description

TABLE 47.

6.5.10 s15Fixed16ArrayType

This type represents an array of generic 4 byte/32 bit fixed point quantity. The number of values is determined from the size of the tag.

byte(s)	content
0-3	'sf32'(0x73663332) type descriptor
4-7	reserved, must be set to 0
8-n	an array of s15Fixed16Number values

TABLE 48.

6.5.11 screeningType

The screeningType describes various screening parameters including screen frequency, screening angle, and spot shape.

byte(s)	content	Encoded As...
0-3	'scrn'(0x7363726E) type descriptor	
4-7	reserved, must be set to 0	
8-11	screening flag	
12-15	number of channels	
16-19	channel #1 frequency	s15Fixed16Number
20-23	channel #1 screen angle	s15Fixed16Number
24-27	channel #1 spot shape	see below
28-n	frequency, screen angle and spot shape for additional channels	

TABLE 49.

Flag encoding is such that:

Attribute	bit position
Use Printer Default Screens (true is 1)	0
Lines/Inch (on is 1) or Lines/cm (off is 0)	1

TABLE 50.

Spot function encoding is such that:

Spot Function Value	Encoded Value
unknown	0
printer default	1
round	2
diamond	3
ellipse	4
line	5
square	6
cross	7

TABLE 51.

6.5.12 signatureType

The signatureType contains a four byte sequence used for signatures. Typically this type is used for tags that need to be registered and can be displayed on many development systems as a sequence of four characters. Sequences of less than four characters are padded at the end with spaces.

byte(s)	content
0-3	'sig '(0x73696720) type descriptor
4-7	reserved, must be set to 0
8-11	four byte signature

TABLE 52.

6.5.13 textType

The textType is a simple text structure that contains a 7 bit ASCII text string. The length of the string can easily be obtained from the element size portion of the tag itself. This string must be terminated with a 0x00 byte.

byte(s)	content
0-3	'text'(0x74657874) type descriptor
4-7	reserved, must be set to 0
8-n	a string of count ASCII characters (where count is derived from the element size portion of the tag itself)

6.5.14 u16Fixed16ArrayType

This type represents an array of generic 4 byte/32 bit quantity. The number of values is determined from the size of the tag.

byte(s)	content
0-3	'uf32'(0x75663332) type descriptor
4-7	reserved, must be set to 0
8-n	an array of u16Fixed16Number values

TABLE 53.

6.5.15 ucrbgType

This type contains curves representing the under color removal and black generation and a text string which is a general description of the method used for the ucr/bg.

byte(s)	content
0-3	'bfd '(0x62666420) type descriptor
4-7	reserved, must be set to 0
8-11	count value specifying number of entries in the ucr curve
12-m	actual ucr curve values starting with the zeroth entry and ending with the entry count-1. Each value is a uInt16Number. If the count is 1, the value is a percent.
m+1 - n	count value specifying number of entries in the bg curve
n+1 - o	actual bg curve values starting with the zeroth entry and ending with the entry count-1. Each value is a uInt16Number. If the count is 1, the value is a percent.
o+1 - p	a string of ASCII characters, with a null terminator.

TABLE 54.

6.5.16 uInt16ArrayType

This type represents an array of generic 2 byte/16 bit quantity. The number of

values is determined from the size of the tag.

byte(s)	content
0-3	'ui16'(0x75693136) type descriptor
4-7	reserved, must be set to 0
8-n	an array of unsigned 16 bit integers

TABLE 55.

6.5.17 uInt32ArrayType

This type represents an array of generic 4 byte/32 bit quantity. The number of values is determined from the size of the tag.

byte(s)	content
0-3	'ui32'(0x75693332) type descriptor
4-7	reserved, must be set to 0
8-n	an array of unsigned 32 bit integers

TABLE 56.

6.5.18 uInt64ArrayType

This type represents an array of generic 8 byte/64 bit quantity. The number of values is determined from the size of the tag.

byte(s)	content
0-3	'ui64'(0x75693634) type descriptor
4-7	reserved, must be set to 0
8-n	an array of unsigned 64 bit integers

TABLE 57.

6.5.19 uInt8ArrayType

This type represents an array of generic 1 byte/8 bit quantity. The number of

values is determined from the size of the tag.

byte(s)	content
0-3	'ui08'(0x75693038) type descriptor
4-7	reserved, must be set to 0
8-n	an array of unsigned 8 bit integers

TABLE 58.

6.5.20 viewingConditionsType

This type represents a set of viewing condition parameters including: absolute illuminant white point tristimulus values and absolute surround tristimulus values.

byte(s)	content	Encoded As...
0-3	'view'(0x76696577) type descriptor	
4-7	reserved, must be set to 0	
8-19	absolute XYZ value for illuminant in cd/m2	XYZNumber
20-31	absolute XYZ value for surround in cd/m2	XYZNumber
32-35	illuminant type	as described in measurementType

TABLE 59.

6.5.21 XYZType

The XYZType contains an array of three encoded values for the XYZ tristimulus values. The number of sets of values is determined from the size of the tag. The byte stream is given below. Tristimulus values must be non-negative, the signed encoding allows for implementation optimizations by minimizing the number of fixed formats.

byte(s)	content	Encoded As...
0-3	'XYZ '(0x58595A20) type descriptor	
4-7	reserved, must be set to 0	
8-n	an array of XYZ numbers	XYZNumber

TABLE 60.

Annex A : Color Spaces

The International Color Profile Format supports a variety of both device-dependent and device-independent color spaces divided into three basic families: 1) CIEXYZ based, 2) RGB based, and 3) CMY based.

The CIE color spaces are defined in CIE publication 14.2 on Colorimetry. A subset of the CIEXYZ based spaces are also defined as exchange spaces. The device dependent spaces below are only representative and other device dependent color spaces may be used without needing to update the profile format specification or the software that uses it.

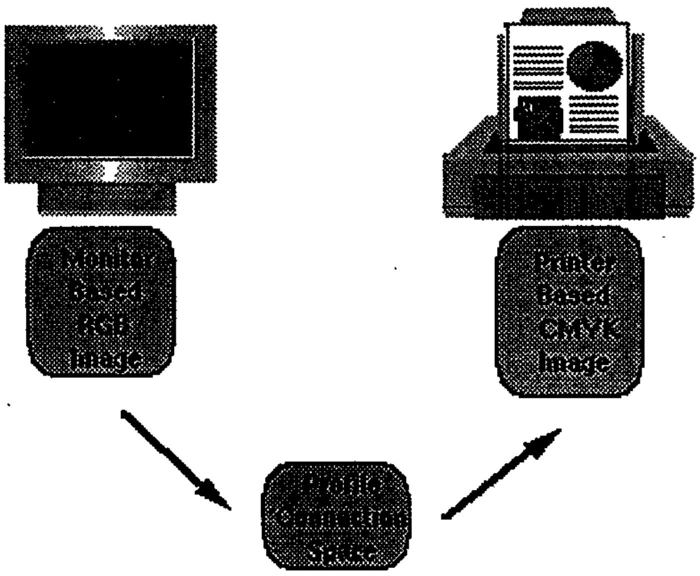
TABLE 1.

Base Space	Description	Derivative Space
CIEXYZ	base CIE device-independent color space	CIELAB
GRAY	monochrome device-dependent color space	
RGB	base additive device-dependent color space	HLS, HSV
CMYK	base subtractive device-dependent color space	CMY

A.1 Profile Connection Spaces

A key component of these profiles is a well-defined profile connection space. This space is the interface which provides an unambiguous connection between the input and output profiles as illustrated in the diagram below. The profile connection space is based on the CIE 1931 standard observer. This experimentally derived standard observer provides a very good representation of the human visual system color matching capabilities. Unlike device dependent color spaces, if two colors have the same CIE colorimetry they will match if viewed under the same conditions. Because the imagery is typically produced for a wide variety of viewing environments, it is necessary to go beyond simple application of the CIE system.

FIGURE 1.



The profile connection space is defined as the CIE colorimetry which will produce the desired color appearance if rendered on a reference imaging media and viewed in a reference viewing environment. This reference corresponds to an ideal reflection print viewed in an ANSI standard viewing booth.

The default measurement parameters for the profile connection space and all other color spaces defined in this specification are based on the ANSI CGATS.5-1993 standard, "Graphic technology - Spectral measurement and colorimetric computation for graphic arts images." Essentially this defines a standard illuminant of D50, the 1931 CIE standard observer, and 0/45 or 45/0 reflectance measurement geometry. The reference viewing condition is ANSI PH2.30-1989, which is a D50 graphic arts viewing environment.

One of the first steps in profile building involves measuring the colorimetry of a set of colors from some imaging media or display. If the imaging media or viewing environment differ from the reference, it will be necessary to adapt the measured colorimetry to that appropriate for the profile connection space. These adaptations account for such differences as white point chromaticity and luminance relative to an ideal reflector, maximum density, viewing surround, viewing illuminant, and flare. Currently, it is the responsibility of the profile builder to do this adaptation.

However, the possibility of allowing a variable illuminant in the PCS is under active consideration by the International Color Consortium. For this reason, a PCS illuminant field is in the profile header, but must be set to the CIE Illuminant D50 [X=0.9642, Y=1.0000, Z=0.8249].

The PCS is based on relative colorimetry. This is in comparison to absolute colorimetry. In absolute colorimetry colors are represented with respect to the illuminant, for example D50. In relative colorimetry, colors are represented with respect to a combination of the illuminant and the media's white, e.g. unprinted paper. The translation from relative colorimetry XYZ data, XYZr to absolute colorimetric data, XYZa, is given by

$$X_a = \left(\frac{X_{mw}}{X_i}\right) \cdot X_r$$

$$Y_a = \frac{Y_{mw}}{Y_i} \cdot Y_r$$

$$Z_a = \left(\frac{Z_{mw}}{Z_i}\right) \cdot Z_r$$

where XYZmw represents the media's white and XYZi represents the illuminant white. The actual media and actual viewing conditions will typically differ from the reference conditions. The profile specification defines tags which provide information about the actual white point and black point of a given media or display. These tags may be used by a CMM to provide functionality beyond that of the default. For example, an advanced CMM could use the tags to adjust colorimetry based on the Dmin of a specific media. A tag is also provided to describe the viewing environment. This information is useful in choosing a profile appropriate for the intended viewing method.

There are many ways of encoding CIE colorimetry. This specification provides three methods in order to satisfy conflicting requirements for accuracy and storage space. These encodings, an 8 bit/component CIELAB encoding, a 16 bit/component CIELAB encoding, and a 16 bit/component CIEXYZ encoding are described in the table below. The CIEXYZ space represents a linear transformation of the derived matching responses and the CIELAB space represents a transformation of the CIEXYZ space into one that is nearly perceptually uniform. This uniformness allows color errors to be equally weighted throughout its domain. While supporting multiple CIE encodings increases the complexity of color management, it provides immense flexibility in addressing different user requirements such as color accuracy and memory footprint.

The encoding is such that

TABLE 2.

Interchange Space	Component	Actual Range	Encoded
CIE XYZ	X	0 -> 1.99997	0000h -> ffffh
CIE XYZ	Y	0 -> 1.99997	0000h -> ffffh
CIE XYZ	Z	0 -> 1.99997	0000h -> ffffh
CIELAB (16 bit)	L*	0 -> 100.0	0000h -> ff00h
CIELAB (16 bit)	a*	-128.0 -> + 127.996	0000h -> ffffh
CIELAB (16 bit)	b*	-128.0 -> + 127.996	0000h -> ffffh
CIELAB (8 bit)	L*	0 -> 100.0	00h -> ffh
CIELAB (8 bit)	a*	-128.0 -> + 127.0	00h -> ffh
CIELAB (8 bit)	b*	-128.0 -> + 127.0	00h -> ffh

An important point to be made is that the PCS is not necessarily intended for the storage of images. A separate series of "interchange color spaces" may be defined in a future version of this specification for this purpose. The design choices made for these spaces (colorimetric encoding, reference media, viewing conditions, etc.) might be different than that of the PCS.

Annex B : Embedding Profiles

This sections details the requirements and options for embedding device profiles within PICT, EPS and TIFF documents. All profiles except abstract profiles can be embedded. The complete profile must be embedded with all tags intact and unchanged.

Embedding devicelink profiles renders the color data device dependent and significantly reduces portability. This may be useful in some situations, but may also cause problems with accurate color reproduction.

B.1 Embedding ICC Profiles in PICT Files

Apple has defined a new QuickDraw picture comment type for embedded ICC profiles. The picture comment value of 224 is followed by a 4-byte selector that describes the type of data in the comment. Using a selector allows the flexibility to embed more CMM related information in the future. The following selectors are currently defined:

TABLE 3.

Selector	Description	
0	Beginning of an ICC profile.	Profile data to follow.
1	Continuation of ICC profile data.	Profile data to follow.
2	End of ICC profile data.	No profile data follows.

Because the dataSize parameter of the PicComment procedure is a signed 16-bit value, the maximum amount of profile data that can be embedded in a single picture comment is 32763 bytes (32767 - 4 bytes for the selector). You can embed a larger profile by using multiple picture comments of selector type 1. The profile data must be embedded in consecutive order, and the last piece of profile data must be followed by a picture comment of selector type 2.

All embedded ICC profiles, including those that fit within a single picture comment, must be followed by the end-of-profile picture comment (selector 2), as shown in the following examples.

Example 1: Embedding a 20K profile.

PicComment kind = 224, dataSize = 20K + 4, selector = 0, profile data = 20K PicComment kind = 224, dataSize = 4, selector = 2

Example 2: Embedding a 50K profile.

PicComment kind = 224, dataSize = 32K, selector = 0, profile data = 32K -

4 PicComment kind = 224, dataSize = 18K + 8, selector = 1, profile data = 18K
+ 4 PicComment kind = 224, dataSize = 4, selector = 2

In ColorSync 1.0, picture comment types CMBeginProfile (220) and CMEndProfile (221) are used to begin and end a picture comment. The CMBeginProfile comment is not supported for ICC profiles; however, the CMEndProfile comment can be used to end the current profile and begin using the System Profile for both ColorSync 1.0 and 2.0.

The CMEnableMatching (222) and CMDisableMatching (223) picture comments are used to begin and end color matching in both ColorSync 1.0 and 2.0

See "Inside Macintosh: Imaging With QuickDraw" for more information about picture comments.

B.2 Embedding ICC Profiles in EPS Files

There are two places within EPS files that embedding International Color Consortium (ICC) profiles are appropriate. 1) Associated with a screen preview. 2) Associated with the page description. Embedding ICC profiles within a screen preview is necessary so that applications using this screen preview to display a representation of the EPS page description can do so with accurate colors. Embedding ICC profiles within a page description is necessary so that sophisticated applications, such as OPI server software, can perform color conversions along with image replacement. For general information concerning PostScript's Document Structuring Conventions (DSC), the EPS file format, or specific PostScript operators, see the PostScript Language Reference Manual, second edition.

1) There are a variety of different methods of storing a screen preview within an EPS file depending on the intended environment. For cross platform applications with embedded ICC profiles, TIFF screen previews are recommended. The TIFF format has been extended to support the embedding of ICC profiles. ICC profiles can also be embedded in a platform specific manner. For example on the Macintosh, Apple has defined a method for embedding ICC profiles in PICT files.

Note that a given page description may use multiple distinct color spaces. In such cases, color conversions must be performed to a single color space to associate with the screen preview.

2) ICC profiles can also be embedded in the page description portion of an EPS file using the%%BeginICCProfile / %%EndICCProfile comments. This

convention is defined as follows.

%%BeginICCProfile: <profileid> <numberof> [<type> [<bytesorlines>]]
<profileid> ::= <text> (Profile ID) <numberof> ::= <int>
(Lines or physical bytes) <type> ::= Hex | ASCII (Type of data)
<bytesorlines> ::= Bytes | Lines (Read in bytes or lines)
%%EndICCProfile (no keywords)

These comments are designed to provide information about embedded ICC profiles. If the type argument is missing, ASCII data is assumed. ASCII refers to an ASCII base-85 representation of the data. If the bytesorlines argument is missing, <numberof> shall be considered to indicate bytes of data. If <numberof> = -1, the number of bytes of data are unknown. In this case, to skip over the profile one must read data until the encountering the%%EndICCProfile comment.

<profileID> provides the profile's ID in order to synchronize it with PostScript's setcolorspace and findcolorrendering operators and associated operands (see below). Note that <numberof> indicates the bytes of physical data, which vary from the bytes of virtual data in some cases. With hex, each byte of virtual data is represented by two ASCII characters (two bytes of physical data). Although the PostScript interpreter ignores white space and percent signs in hex and ASCII data, these count toward the byte count.

Each line of profile data shall begin with a single percent sign followed by a space (%). This makes the entire profile section a PostScript language comment so the file can be sent directly to a printer without modification. The space avoids confusion with the open extension mechanism associated with DSC comments.

ICC profiles can be embedded within EPS files to allow sophisticated applications, such as OPI server software, to extract the profiles, and to perform color processing based on these profiles. In such situations it is desirable to locate the page description's color space and rendering intent, since this color space and rendering intent may need to be modified based on any color processing. The %%BeginSetColorSpace / %%EndSetColorSpace and %%BeginRenderingIntent / %%EndRenderingIntent comments are used to delimit the color space and rendering intent respectively.

%%BeginSetColorSpace <profileid> <profileid> ::= <text> (ICC Profile ID) %%EndSetColorSpace (no keywords)

<profileid> provides the ICC profile's ID corresponding to this color space. The ICC profile with this profile must have occured in the PostScript job using the %%BeginICCProfile / %%EndICCProfile comment convention prior to this particular %%BeginSetColorSpace comment.

An example usage is shown here for CIE 1931 (XYZ)-space with D65 white point that refers to the ICC profile with <profileid> = XYZProfile.

%%BeingSetColorSpace XYZProfile [/CIEBasedABC << /WhitePoint [0.9505 1 1.0890] /RangeABC [0 0.9505 0 1 0 1.0890] /RangeLMN [0 0.9505 0 1 0 1.0890] >>] setcolorspace %%EndSetColorSpace

Note that the setcolorspace command is included within the comments. The PostScript enclosed in these comments shall not perform any other operations other than setting the color space and shall have no side effects.

%%BeginRenderingIntent <profileid> <profileid> ::= <text> (ICC Profile ID) %%EndRenderingIntent

<profileid> provides the ICC profile's ID corresponding to this rendering intent. The ICC profile with this profile must have occured in the PostScript job using the %%BeginICCProfile / %%EndICCProfile comment convention prior to invocation of this particular %%BeginRenderingIntent comment.

An example usage is shown here for the the Perceptual rendering intent that refers to the ICC profile with <profileid> = RGBProfile.

%%BeginRenderingIntent RGBProfile /Perceptual findcolorrendering pop /ColorRendering findresource setcolorrendering %%EndRenderingIntent

Note that the setcolorrendering command is included within the comments. The PostScript enclosed in these comments shall not perform any other operations other than setting the rendering intent and shall have no side effects.

B.3 Embeding ICC Profiles in TIFF Files

The discussion below assumes some familiarity with TIFF internal structure. It is beyond the scope of this document to detail the TIFF format, and readers are referred to the "TIFF(tm) Revision 6.0" specification, which is available from the Adobe Corporation.

The International Color Consortium (ICC) has been assigned a private TIFF tag for purposes of embedding ICC device profiles within TIFF image files. This is not a required TIFF tag, and Baseline TIFF readers are not currently required to read it. It is, however, strongly recommended that this tag be honored.

A ICC device profile is embedded, in its entirety, as a single TIFF field or

Image File Directory (IFD) entry in the IFD containing the corresponding image data. An IFD should contain no more than one embedded profile. A TIFF file may contain more than one image, and so, more than one IFD. Each IFD may have its own embedded profile. Note, however, that Baseline TIFF readers are not required to read any IFDs beyond the *first* one.

The structure of the ICC Profile IFD Entry is as follows.

TABLE 4.

Byte Position	
0-1	The TIFFTag that identifies the field = 34675(8773.H)
2-3	The field Type = 7 = UNDEFINED (treated as 8-bit bytes).
4-7	The Count of values = the size of the embedded ICC profile in bytes.
8-11	The Value Offset = the file offset, in bytes, to the beginning of the ICC profile.

Like all IFD entry values, the embedded profile must begin on a word boundary, so the Value Offset will always be an even number.

A TIFF reader should have no knowledge of the internal structure of an embedded ICC profile and should extract the profile intact.

Annex C: C Header File Example

This annex provides a cross-platform conditionally compilable header file for the InterColor Profile Format.

```
/* Header file guard bands */
#ifndef ICC_H
#define ICC_H

/***************************************************************
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****************************************************************/

/*
 * This version of the header file corresponds to the profile
 * specification version 3.0.
 *
 * All header file entries are pre-fixed with "ic" to help
 * avoid name space collisions. Signatures are pre-fixed with
 * icSig.
 *
 * The structures defined in this header file were created to
 * represent a description of an ICC profile on disk. Rather
 * than use pointers a technique is used where a single byte array
 * was placed at the end of each structure. This allows us in "C"
 * to extend the structure by allocating more data than is needed
 * to account for variable length structures.
 *
 * This also ensures that data following is allocated
```

```
 * contiguously and makes it easier to write and read data from
 * the file.
 *
 * For example to allocate space for a 256 count length UCR
 * and BG array, and fill the allocated data.  Note strlen + 1
 * to remember NULL terminator.
 *
      icUcrBgCurve*ucrCurve, *bgCurve;
      int          ucr_nbytes, bg_nbytes, string_bytes;
      icUcrBg      *ucrBgWrite;
      char         ucr_string[100], *ucr_char;

      strcpy(ucr_string, "Example ucrBG curves");
      ucr_nbytes = sizeof(icUInt32Number) +
                   (UCR_CURVE_SIZE * sizeof(icUInt16Number));
      bg_nbytes = sizeof(icUInt32Number) +
                   (BG_CURVE_SIZE * sizeof(icUInt16Number));
      string_bytes = strlen(ucr_string) + 1;

      ucrBgWrite = (icUcrBg *)malloc(
                          (ucr_nbytes + bg_nbytes + string_bytes));

      ucrCurve = (icUcrBgCurve *)ucrBgWrite->data;
      ucrCurve->count = UCR_CURVE_SIZE;
      for (i=0; i<ucrCurve->count; i++)
            ucrCurve->curve[i] = (icUInt16Number)i;

      bgCurve = (icUcrBgCurve *)((char *)ucrCurve + ucr_nbytes);
      bgCurve->count = BG_CURVE_SIZE;
      for (i=0; i<bgCurve->count; i++)
            bgCurve->curve[i] = 255 - (icUInt16Number)i;

      ucr_char = (char *)((char *)bgCurve + bg_nbytes);
      memcpy(ucr_char, ucr_string, string_bytes);
 *
 */

/*
 * Many of the structures contain variable length arrays. This
 * is represented by the use of the convention.
 *
 *      type    data[icAny];
 */

/*------------------------------------------------------------------------*/
/*
 * Defines used in the specification
 */
#defineicMagicNumber        0x61637370L/* 'acsp' */
#define icVersionNumber0x02000000L/* 2.0, BCD */

/* Screening Encodings */
#defineicPrtrDefaultScreensFalse0x00000000L/* Bit position 0 */
#defineicPrtrDefaultScreensTrue0x00000001L/* Bit position 0 */
#define icLinesPerInch0x00000002L/* Bit position 1 */
#define icLinesPerCm0x00000000L/* Bit position 1 */

/*
 * Device attributes, currently defined values correspond
```

```
 * to the low 4 bytes of the 8 byte attribute quantity, see
 * the header for their location.
 */
#define icReflective0x00000000L/* Bit position 0 */
#define icTransparency0x00000001L/* Bit position 0 */
#define icGlossy    0x00000000L/* Bit position 1 */
#define icMatte            0x00000002L/* Bit position 1 */

/*
 * Profile header flags, the low 16 bits are reserved for consortium
 * use.
 */
#defineicEmbeddedProfileFalse0x00000000L/* Bit position 0 */
#defineicEmbeddedProfileTrue0x00000001L/* Bit position 0 */
#define icUseAnywhere0x00000000L/* Bit position 1 */
#define icUseWithEmbeddedDataOnly0x00000002L/* Bit position 1 */

/* Ascii or Binary data */
#define icAsciiData 0x00000000L/* Used in dataType */
#define icBinaryData0x00000001L

/*
 * Define used to indicate that this is a variable length array
 */
#define icAny            1


/*------------------------------------------------------------------------*/
/*
 * Use this area to translate platform definitions of long
 * etc into icXXX form. The rest of the header uses the icXXX
 * typedefs. Signatures are 4 byte quantities.
 */
#ifdef __sgi
#include "sgidefs.h"

typedef __int32_t     icSignature;

/*
 * Number definitions
 */

/* Unsigned integer numbers */
typedef unsigned charicUInt8Number;
typedef unsigned shorticUInt16Number;
typedef __uint32_ticUInt32Number;
typedef __uint32_ticUInt64Number[2];

/* Signed numbers */
typedef char icInt8Number;
typedef short icInt16Number;
typedef __int32_ticInt32Number;
typedef __int32_ticInt64Number[2];

/* Fixed numbers */
typedef __int32_ticS15Fixed16Number;
typedef__uint32_ticU16Fixed16Number;
#endif /* Silicon Graphics */
```

```
#if defined(sun) || defined(__sun)/* 32-bit Solaris, SunOS */

typedef long icSignature;

/*
 * Number definitions
 */

/* Unsigned integer numbers */
typedef unsigned charicUInt8Number;
typedef unsigned shorticUInt16Number;
typedef unsigned longicUInt32Number;
typedef unsigned longicUInt64Number[2];

/* Signed numbers */
typedef char icInt8Number;
typedef short icInt16Number;
typedef long icInt32Number;
typedef long icInt64Number[2];

/* Fixed numbers */
typedef long icS15Fixed16Number;
typedefunsigned longicU16Fixed16Number;
#endif /* 32-bit Solaris, SunOS */

/*------------------------------------------------------------------------*/
/* public tags and sizes */
typedef enum {
    icSigAToB0Tag   = 0x41324230L,/* 'A2B0' */
    icSigAToB1Tag   = 0x41324231L,/* 'A2B1' */
    icSigAToB2Tag   = 0x41324232L,/* 'A2B2' */
    icSigBlueColorantTag= 0x6258595AL,/* 'bXYZ' */
    icSigBlueTRCTag = 0x62545243L,/* 'bTRC' */
    icSigBToA0Tag   = 0x42324130L,/* 'B2A0' */
    icSigBToA1Tag   = 0x42324131L,/* 'B2A1' */
    icSigBToA2Tag   = 0x42324132L,/* 'B2A2' */
    icSigCalibrationDateTimeTag= 0x63616C74L,/* 'calt' */
    icSigCharTargetTag= 0x74617267L,/* 'targ' */
    icSigCopyrightTag= 0x63707274L,/* 'cprt' */
    icSigDeviceMfgDescTag= 0x646D6E64L,/* 'dmnd' */
    icSigDeviceModelDescTag= 0x646D6464L,/* 'dmdd' */
    icSigGamutTag   = 0x67616d74L,/* 'gamt' */
    icSigGrayTRCTag = 0x6b545243L,/* 'kTRC' */
    icSigGreenColorantTag= 0x6758595AL,/* 'gXYZ' */
    icSigGreenTRCTag= 0x67545243L,/* 'gTRC' */
    icSigLuminanceTag= 0x6C756d69L,/* 'lumi' */
    icSigMeasurementTag= 0x6D656173L,/* 'meas' */
    icSigMediaBlackPointTag= 0x626B7074L,/* 'bkpt' */
    icSigMediaWhitePointTag= 0x77747074L,/* 'wtpt' */
    icSigNamedColorTag= 0x6E636f6CL,/* 'ncol' */
    icSigPreview0Tag= 0x70726530L,/* 'pre0' */
    icSigPreview1Tag= 0x70726531L,/* 'pre1' */
    icSigPreview2Tag= 0x70726532L,/* 'pre2' */
    icSigProfileDescriptionTag= 0x64657363L,/* 'desc' */
    icSigProfileSequenceDescTag= 0x70736571L,/* 'pseq' */
    icSigPs2CRD0Tag = 0x70736430L,/* 'psd0' */
    icSigPs2CRD1Tag = 0x70736431L,/* 'psd1' */
    icSigPs2CRD2Tag = 0x70736432L,/* 'psd2' */
    icSigPs2CRD3Tag = 0x70736433L,/* 'psd3' */
```

```
    icSigPs2CSATag   = 0x70733273L,/* 'ps2s' */
    icSigPs2RenderingIntentTag= 0x70733269L,/* 'ps2i' */
    icSigRedColorantTag= 0x7258595AL,/* 'rXYZ' */
    icSigRedTRCTag   = 0x72545243L,/* 'rTRC' */
    icSigScreeningDescTag= 0x73637264L,/* 'scrd' */
    icSigScreeningTag= 0x7363726EL,/* 'scrn' */
    icSigTechnologyTag= 0x74656368L,/* 'tech' */
    icSigUcrBgTag    = 0x62666420L,/* 'bfd ' */
    icSigViewingCondDescTag= 0x76756564L,/* 'vued' */
    icSigViewingConditionsTag= 0x76696577L,/* 'view' */
    icMaxEnumTag     = 0xFFFFFFFFL/* enum = 4 bytes max */
} icTagSignature;

/* technology signature descriptions */
typedef enum {
    icSigFilmScanner= 0x6673636EL,/* 'fscn' */
    icSigReflectiveScanner= 0x7273636EL,/* 'rscn' */
    icSigInkJetPrinter= 0x696A6574L,/* 'ijet' */
    icSigThermalWaxPrinter= 0x74776178L,/* 'twax' */
    icSigElectrophotographicPrinter= 0x6570686FL,/* 'epho' */
    icSigElectrostaticPrinter= 0x65737461L,/* 'esta' */
    icSigDyeSublimationPrinter= 0x64737562L,/* 'dsub' */
    icSigPhotographicPaperPrinter= 0x7270686FL,/* 'rpho' */
    icSigFilmWriter = 0x6670726EL,/* 'fprn' */
    icSigVideoMonitor= 0x7669646DL,/* 'vidm' */
    icSigVideoCamera= 0x76696463L,/* 'vidc' */
    icSigProjectionTelevision= 0x706A7476L,/* 'pjtv' */
    icSigCRTDisplay  = 0x43525420L,/* 'CRT ' */
    icSigPMDisplay   = 0x504D4420L,/* 'PMD ' */
    icSigAMDisplay   = 0x414D4420L,/* 'AMD ' */
    icSigPhotoCD     = 0x4B504344L,/* 'KPCD' */
    icSigPhotoImageSetter= 0x696D6773L,/* 'imgs' */
    icSigGravure     = 0x67726176L,/* 'grav' */
    icSigOffsetLithography= 0x6F666673L,/* 'offs' */
    icSigSilkscreen = 0x73696C6BL, /* 'silk' */
    icSigFlexography= 0x666C6578L,/* 'flex' */
    icMaxEnumTechnology= 0xFFFFFFFFL/* enum = 4 bytes max */
} icTechnologySignature;

/* type signatures */
typedef enum {
    icSigCurveType   = 0x63757276L,/* 'curv' */
    icSigDataType    = 0x64617461L,/* 'data' */
    icSigDateTimeType= 0x6474696DL,/* 'dtim' */
    icSigLut16Type   = 0x6d667432L,/* 'mft2' */
    icSigLut8Type    = 0x6d667431L,/* 'mft1' */
    icSigMeasurementType= 0x6D656173L,/* 'meas' */
    icSigNamedColorType= 0x6E636f6CL,/* 'ncol' */
    icSigProfileSequenceDescType= 0x70736571L,/* 'pseq' */
    icSigS15Fixed16ArrayType= 0x73663332L,/* 'sf32' */
    icSigScreeningType= 0x7363726EL,/* 'scrn' */
    icSigSignatureType= 0x73696720L,/* 'sig ' */
    icSigTextType    = 0x74657874L,/* 'text' */
    icSigTextDescriptionType= 0x64657363L,/* 'desc' */
    icSigU16Fixed16ArrayType= 0x75663332L,/* 'uf32' */
    icSigUcrBgType   = 0x62666420L,/* 'bfd ' */
    icSigUInt16ArrayType= 0x75693136L,/* 'ui16' */
    icSigUInt32ArrayType= 0x75693332L,/* 'ui32' */
    icSigUInt64ArrayType= 0x75693634L,/* 'ui64' */
```

```
    icSigUInt8ArrayType= 0x75693038L,/* 'ui08' */
    icSigViewingConditionsType= 0x76696577L,/* 'view' */
    icSigXYZType     = 0x58595A20L,/* 'XYZ ' */
    icSigXYZArrayType= 0x58595A20L,/* 'XYZ ' */
    icMaxEnumType    = 0xFFFFFFFFL/* enum = 4 bytes max */
} icTagTypeSignature;

/*
 * Color Space Signatures
 * Note that only icSigXYZData and icSigLabData are valid
 * Profile Connection Spaces (PCSs)
 */
typedef enum {
    icSigXYZData     = 0x58595A20L,/* 'XYZ ' */
    icSigLabData     = 0x4C616220L,/* 'Lab ' */
    icSigLuvData     = 0x4C757620L,/* 'Luv ' */
    icSigYCbCrData   = 0x59436272L,/* 'YCbr' */
    icSigYxyData     = 0x59787920L,/* 'Yxy ' */
    icSigRgbData     = 0x52474220L,/* 'RGB ' */
    icSigGrayData    = 0x47524159L,/* 'GRAY' */
    icSigHsvData     = 0x48535620L,/* 'HSV ' */
    icSigHlsData     = 0x484C5320L,/* 'HLS ' */
    icSigCmykData    = 0x434D594BL,/* 'CMYK' */
    icSigCmyData     = 0x434D5920L,/* 'CMY ' */
    icMaxEnumData    = 0xFFFFFFFFL/* enum = 4 bytes max */
} icColorSpaceSignature;

/* profileClass enumerations */
typedef enum {
    icSigInputClass = 0x73636E72L,/* 'scnr' */
    icSigDisplayClass= 0x6D6E7472L,/* 'mntr' */
    icSigOutputClass= 0x70727472L,/* 'prtr' */
    icSigLinkClass  = 0x6C696E6BL,/* 'link' */
    icSigAbstractClass= 0x61627374L,/* 'abst' */
    icSigColorSpaceClass= 0x73706163L,/* 'spac' */
    icMaxEnumClass  = 0xFFFFFFFFL/* enum = 4 bytes max */
} icProfileClassSignature;

/* Platform Signatures */
typedef enum {
    icSigMacintosh  = 0x4150504CL,/* 'APPL' */
    icSigMicrosoft  = 0x4D534654L,/* 'MSFT' */
    icSigSolaris    = 0x53554E57L,/* 'SUNW' */
    icSigSGI               = 0x53474920L,/* 'SGI ' */
    icSigTaligent   = 0x54474E54L,/* 'TGNT' */
    icMaxEnumPlatform= 0xFFFFFFFFL/* enum = 4 bytes max */
} icPlatformSignature;

/*------------------------------------------------------------------------*/
/*
 * Other enums
 */

/* Measurement Flare, used in the measurmentType tag */
typedef enum {
    icFlare0               = 0x00000000L,/* 0% flare */
    icFlare100             = 0x00000001L,/* 100% flare */
    icMaxFlare             = 0xFFFFFFFFL/* enum = 4 bytes max */
} icMeasurementFlare;
```

```
/* Measurement Geometry, used in the measurmentType tag */
typedef enum {
    icGeometryUnknown= 0x00000000L,/* Unknown geometry */
    icGeometry045or450= 0x00000001L,/* 0/45 or 45/0 */
    icGeometry0dord0= 0x00000002L,/* 0/d or d/0 */
    icMaxGeometry    = 0xFFFFFFFFL/* enum = 4 bytes max */
} icMeasurementGeometry;

/* Rendering Intents, used in the profile header */
typedef enum {
    icPerceptual     = 0,
    icRelativeColorimetric= 1,
    icSaturation     = 2,
    icAbsoluteColorimetric= 3,
    icMaxEnumIntent = 0xFFFFFFFFL/* enum = 4 bytes max */
} icRenderingIntent;

/* Different Spot Shapes currently defined, used for screeningType */
typedef enum {
    icSpotShapeUnknown= 0,
    icSpotShapePrinterDefault= 1,
    icSpotShapeRound= 2,
    icSpotShapeDiamond= 3,
    icSpotShapeEllipse= 4,
    icSpotShapeLine = 5,
    icSpotShapeSquare= 6,
    icSpotShapeCross= 7,
    icMaxEnumSpot    = 0xFFFFFFFFL/* enum = 4 bytes max */
} icSpotShape;

/* Standard Observer, used in the measurmentType tag */
typedef enum {
    icStdObsUnknown = 0x00000000L,/* Unknown observer */
    icStdObs1931TwoDegrees= 0x00000001L,/* 1931 two degrees */
    icStdObs1964TenDegrees= 0x00000002L,/* 1961 ten degrees */
    icMaxStdObs              = 0xFFFFFFFFL/* enum = 4 bytes max */
} icStandardObserver;

/* Pre-defined illuminants, used in measurement and viewing conditions type */
typedef enum {
    icIlluminantUnknown= 0x00000000L,
    icIlluminantD50 = 0x00000001L,
    icIlluminantD65 = 0x00000002L,
    icIlluminantD93 = 0x00000003L,
    icIlluminantF2  = 0x00000004L,
    icIlluminantD55 = 0x00000005L,
    icIlluminantA   = 0x00000006L,
    icIlluminantEquiPowerE= 0x00000007L,/* Equi-Power (E) */
    icIlluminantF8  = 0x00000008L,
    icMaxEnumIluminant= 0xFFFFFFFFL/* enum = 4 bytes max */
} icIlluminant;

/*------------------------------------------------------------------------*/
/*
 * Arrays of numbers
 */
```

```
/* Int8 Array */
typedef struct {
    icInt8Numberdata[icAny];/* Variable array of values */
} icInt8Array;

/* UInt8 Array */
typedef struct {
    icUInt8Numberdata[icAny];/* Variable array of values */
} icUInt8Array;

/* uInt16 Array */
typedef struct {
    icUInt16Numberdata[icAny];/* Variable array of values */
} icUInt16Array;

/* Int16 Array */
typedef struct {
    icInt16Numberdata[icAny];/* Variable array of values */
} icInt16Array;

/* uInt32 Array */
typedef struct {
    icUInt32Numberdata[icAny];/* Variable array of values */
} icUInt32Array;

/* Int32 Array */
typedef struct {
    icInt32Numberdata[icAny];/* Variable array of values */
} icInt32Array;

/* UInt64 Array */
typedef struct {
    icUInt64Numberdata[icAny];/* Variable array of values */
} icUInt64Array;

/* Int64 Array */
typedef struct {
    icInt64Numberdata[icAny];/* Variable array of values */
} icInt64Array;

/* u16Fixed16 Array */
typedef struct {
    icU16Fixed16Numberdata[icAny];/* Variable array of values */
} icU16Fixed16Array;

/* s15Fixed16 Array */
typedef struct {
    icS15Fixed16Numberdata[icAny];/* Variable array of values */
} icS15Fixed16Array;

/* The base date time number */
typedef struct {
    icUInt16Numberyear;
    icUInt16Numbermonth;
    icUInt16Numberday;
    icUInt16Numberhours;
    icUInt16Numberminutes;
    icUInt16Numberseconds;
} icDateTimeNumber;
```

```
/* XYZ Number  */
typedef struct {
    icS15Fixed16NumberX;
    icS15Fixed16NumberY;
    icS15Fixed16NumberZ;
} icXYZNumber;

/* XYZ Array */
typedef struct {
    icXYZNumberdata[icAny];/* Variable array of XYZ numbers */
} icXYZArray;

/* Curve */
typedef struct {
    icUInt32Numbercount;/* Number of entries */
    icUInt16Numberdata[icAny];/* The actual table data, real
                                   * number is determined by count
                              * Interpretation depends on how
                              * data is used with a given tag.
                              */
} icCurve;

/* Data */
typedef struct {
    icUInt32NumberdataFlag;/* 0 = ascii, 1 = binary */
    icInt8Numberdata[icAny];/* Data, size determined from tag */
} icData;

/* lut16 */
typedef struct {
    icUInt8NumberinputChan;/* Number of input channels */
    icUInt8NumberoutputChan;/* Number of output channels */
    icUInt8NumberclutPoints;/* Number of clutTable grid points */
    icInt8Numberpad;/* Padding for byte alignment */
    icS15Fixed16Numbere00;/* e00 in the 3 * 3 */
    icS15Fixed16Numbere01;/* e01 in the 3 * 3 */
    icS15Fixed16Numbere02;/* e02 in the 3 * 3 */
    icS15Fixed16Numbere10;/* e10 in the 3 * 3 */
    icS15Fixed16Numbere11;/* e11 in the 3 * 3 */
    icS15Fixed16Numbere12;/* e12 in the 3 * 3 */
    icS15Fixed16Numbere20;/* e20 in the 3 * 3 */
    icS15Fixed16Numbere21;/* e21 in the 3 * 3 */
    icS15Fixed16Numbere22;/* e22 in the 3 * 3 */
    icUInt16NumberinputEnt;/* Number of input table entries */
    icUInt16NumberoutputEnt;/* Number of output table entries */
    icUInt16Numberdata[icAny];/* Data follows see spec for size */
/*
 *  Data that follows is of this form
 *
 *  icUInt16NumberinputTable[inputChan][icAny];* The input table
 *  icUInt16NumberclutTable[icAny];* The clut table
 *  icUInt16NumberoutputTable[outputChan][icAny];* The output table
 */
} icLut16;

/* lut8, input & output tables are always 256 bytes in length */
typedef struct {
    icUInt8NumberinputChan;/* Number of input channels */
```

```
    icUInt8NumberoutputChan;/* Number of output channels */
    icUInt8NumberclutPoints;/* Number of clutTable grid points */
    icInt8Numberpad;
    icS15Fixed16Numbere00;/* e00 in the 3 * 3 */
    icS15Fixed16Numbere01;/* e01 in the 3 * 3 */
    icS15Fixed16Numbere02;/* e02 in the 3 * 3 */
    icS15Fixed16Numbere10;/* e10 in the 3 * 3 */
    icS15Fixed16Numbere11;/* e11 in the 3 * 3 */
    icS15Fixed16Numbere12;/* e12 in the 3 * 3 */
    icS15Fixed16Numbere20;/* e20 in the 3 * 3 */
    icS15Fixed16Numbere21;/* e21 in the 3 * 3 */
    icS15Fixed16Numbere22;/* e22 in the 3 * 3 */
    icUInt8Numberdata[icAny];/* Data follows see spec for size */
/*
 *  Data that follows is of this form
 *
 *  icUInt8NumberinputTable[inputChan][256];/* The input table
 *  icUInt8NumberclutTable[icAny];/* The clut table
 *  icUInt8NumberoutputTable[outputChan][256];/* The output table
 */
} icLut8;

/* Measurement Data */
typedef struct {
    icStandardObserverstdObserver;/* Standard observer */
    icXYZNumber     backing;/* XYZ for backing material */
    icMeasurementGeometrygeometry;/* Measurement geometry */
    icMeasurementFlareflare;/* Measurement flare */
    icIlluminantilluminant;/* Illuminant */
} icMeasurement;

/* Named color */
typedef struct {
    icUInt32NumbervendorFlag;/* Bottom 16 bits for IC use */
    icUInt32Numbercount;/* Count of named colors */
    icInt8Numberdata[icAny];/* Named color data follows */
/*
 *  Data that follows is of this form
 *
 * icInt8Numberprefix[icAny];* Prefix for the color name, max = 32
 * icInt8Numbersuffix[icAny];* Suffix for the color name, max = 32
 * icInt8Numberroot1[icAny];* Root name for first color, max = 32
 * icInt8Numbercoords1[icAny];* Color co-ordinates of first color
 * icInt8Numberroot2[icAny];* Root name for first color, max = 32
 * icInt8Numbercoords2[icAny];* Color co-ordinates of first color
 *                 :
 *                 :
 * Repeat for root name and color co-ordinates up to (count-1)
 */
} icNamedColor;

/* Profile sequence structure */
typedef struct {
    icSignature     deviceMfg;/* Device Manufacturer */
    icSignature     deviceModel;/* Decvice Model */
    icUInt64Numberattributes;/* Device attributes */
    icTechnologySignaturetechnology;/* Technology signature */
    icInt8Numberdata[icAny];/* Descriptions text follows */
/*
```

```
 *  Data that follows is of this form, this is an icInt8Number
 *  to avoid problems with a compiler generating  bad code as
 *  these arrays are variable in length.
 *
 * icTextDescriptiondeviceMfgDesc;* Manufacturer text
 * icTextDescription    modelDesc;* Model text
 */
} icDescStruct;

/* Profile sequence description */
typedef struct {
    icUInt32Numbercount;/* Number of descriptions */
    icUInt8Numberdata[icAny];/* Array of description struct */
} icProfileSequenceDesc;

/* textDescription */
typedef struct {
    icUInt32Numbercount;/* Description length */
    icInt8Numberdata[icAny];/* Descriptions follow */
/*
 *  Data that follows is of this form
 *
 * icInt8Numberdesc[count]* NULL terminated ascii string
 * icUInt32NumberucLangCode;* UniCode language code
 * icUInt32NumberucCount;* UniCode description length
 * icInt16NumberucDesc[ucCount];* The UniCode description
 * icUInt16NumberscCode;* ScriptCode code
 * icUInt8NumberscCount;* ScriptCode count
 * icInt8NumberscDesc[67];* ScriptCode Description
 */
} icTextDescription;

/* Screening Data */
typedef struct {
    icS15Fixed16Numberfrequency;/* Frequency */
    icS15Fixed16Numberangle;/* Screen angle */
    icSpotShapespotShape;/* Spot Shape encodings below */
} icScreeningData;

typedef struct {
    icUInt32NumberscreeningFlag;/* Screening flag */
    icUInt32Numberchannels;/* Number of channels */
    icScreeningDatadata[icAny];/* Array of screening data */
} icScreening;

/* Text Data */
typedef struct {
    icInt8Numberdata[icAny];/* Variable array of characters */
} icText;

/* Structure describing either a UCR or BG curve */
typedef struct {
    icUInt32Numbercount;/* Curve length */
    icUInt16Numbercurve[icAny];/* The array of curve values */
} icUcrBgCurve;

/* Under color removal, black generation */
typedef struct {
    icInt8Numberdata[icAny];/* The Ucr BG data */
```

```
/*
 *  Data that follows is of this form, this is a icInt8Number
 *  to avoid problems with a compiler generating  bad code as
 *  these arrays are variable in length.
 *
 * icUcrBgCurveucr;          * Ucr curve
 * icUcrBgCurvebg;           * Bg curve
 * icInt8Numberstring;       * UcrBg description
 */
} icUcrBg;

/* viewingConditionsType */
typedef struct {
    icXYZNumberilluminant;/* In candelas per metre sq'd */
    icXYZNumbersurround;/* In candelas per metre sq'd */
    icIlluminantstdIluminant;/* See icIlluminant defines */
} icViewingCondition;


/*------------------------------------------------------------------------*/
/*
 * Tag Type definitions
 */

/*
 * Many of the structures contain variable length arrays. This
 * is represented by the use of the convention.
 *
 *     type   data[icAny];
 */

/* The base part of each tag */
typedef struct {
    icTagTypeSignaturesig;/* Signature */
    icInt8Numberreserved[4];/* Reserved, set to 0 */
} icTagBase;

/* curveType */
typedef struct {
    icTagBase base;          /* Signature, "curv" */
    icCurve   curve;         /* The curve data */
} icCurveType;

/* dataType */
typedef struct {
    icTagBase base;          /* Signature, "data" */
    icData    data;          /* The data structure */
} icDataType;

/* dateTimeType */
typedef struct {
    icTagBase base;          /* Signature, "dtim" */
    icDateTimeNumberdate;/* The date */
} icDateTimeType;

/* lut16Type */
typedef struct {
    icTagBase base;          /* Signature, "mft2" */
    icLut16   lut;           /* Lut16 data */
```

```
} icLut16Type;

/* lut8Type, input & output tables are always 256 bytes in length */
typedef struct {
    icTagBase base;         /* Signature, "mft1" */
    icLut8    lut;          /* Lut8 data */
} icLut8Type;

/* Measurement Type */
typedef struct {
    icTagBase base;         /* Signature, "meas" */
    icMeasurementmeasurement;/* Measurement data */
} icMeasurementType;

/* Named color type */
typedef struct {
    icTagBase base;         /* Signature, "ncol" */
    icNamedColorncolor;/* Named color data */
} icNamedColorType;

/* Profile sequence description type */
typedef struct {
    icTagBase       base;  /* Signature, "pseq" */
    icProfileSequenceDescdesc;/* The seq description */
} icProfileSequenceDescType;

/* textDescriptionType */
typedef struct {
    icTagBase       base;  /* Signature, "desc" */
    icTextDescriptiondesc; /* The description */
} icTextDescriptionType;

/* s15Fixed16Type */
typedef struct {
    icTagBase base;         /* Signature, "sf32" */
    icS15Fixed16Arraydata;/* Array of values */
} icS15Fixed16ArrayType;

typedef struct {
    icTagBase base;         /* Signature, "scrn" */
    icScreeningscreen;      /* Screening structure */
} icScreeningType;

/* sigType */
typedef struct {
    icTagBase base;         /* Signature, "sig" */
    icSignaturesignature;/* The signature data */
} icSignatureType;

/* textType */
typedef struct {
    icTagBase base;         /* Signature, "text" */
    icText    data;         /* Variable array of characters */
} icTextType;

/* u16Fixed16Type */
typedef struct {
    icTagBase base;         /* Signature, "uf32" */
    icU16Fixed16Arraydata;/* Variable array of values */
```

```
} icU16Fixed16ArrayType;

/* Under color removal, black generation type */
typedef struct {
    icTagBase base;          /* Signature, "bfd " */
    icUcrBg   data;          /* ucrBg structure */
} icUcrBgType;

/* uInt16Type */
typedef struct {
    icTagBase base;          /* Signature, "ui16" */
    icUInt16Array data;/* Variable array of values */
} icUInt16ArrayType;

/* uInt32Type */
typedef struct {
    icTagBase base;          /* Signature, "ui32" */
    icUInt32Array data;/* Variable array of values */
} icUInt32ArrayType;

/* uInt64Type */
typedef struct {
    icTagBase base;          /* Signature, "ui64" */
    icUInt64Array data;/* Variable array of values */
} icUInt64ArrayType;

/* uInt8Type */
typedef struct {
    icTagBase base;          /* Signature, "ui08" */
    icUInt8Array data;/* Variable array of values */
} icUInt8ArrayType;

/* viewingConditionsType */
typedef struct {
    icTagBase base;          /* Signature, "view" */
    icViewingCondition view;/* Viewing conditions */
} icViewingConditionType;

/* XYZ Type */
typedef struct {
    icTagBase base;          /* Signature, "XYZ" */
    icXYZArray data;         /* Variable array of XYZ numbers */
} icXYZType;

/*------------------------------------------------------------------------*/

/*
 * Lists of tags, tags, profile header and profile strcuture
 */

/* A tag */
typedef struct {
    icTagSignature sig;/* The tag signature */
    icUInt32Number offset;/* Start of tag relative to
                           * start of header, Spec Section 8 */
    icUInt32Number size;/* Size in bytes */
} icTag;

/* A Structure that may be used independently for a list of tags */
```

```
typedef struct {
    icUInt32Numbercount;/* Number of tags in the profile */
    icTag     tags[icAny];/* Variable array of tags */
} icTagList;

/* The Profile header */
typedef struct {
    icUInt32Numbersize;    /* Profile size in bytes */
    icSignature      cmmId;         /* CMM for this profile */
    icUInt32Numberversion;/* Format version number */
    icProfileClassSignaturedeviceClass;/* Type of profile */
    icColorSpaceSignaturecolorSpace;/* Color space of data */
    icColorSpaceSignaturepcs;/* PCS, XYZ or Lab only */
    icDateTimeNumberdate;  /* Date profile was created */
    icSignature      magic;         /* icMagicNumber */
    icPlatformSignatureplatform;/* Primary Platform */
    icUInt32Numberflags;   /* Various bit settings */
    icSignature      manufacturer;/* Device manufacturer */
    icUInt32Numbermodel;   /* Device model number */
    icUInt64Numberattributes;/* Device attributes */
    icUInt32NumberrenderingIntent;/* Rendering intent */
    icXYZNumber      illuminant;/* Profile illuminant */
    icInt8Numberreserved[48];/* Reserved for future use */
} icHeader;

/*
 * A profile,
 * we can't use icTagList here because its not at the end of the structure
 */
typedef struct {
    icHeader header;       /* The header */
    icUInt32Numbercount;/* Number of tags in the profile */
    icInt8Numberdata[icAny];/* The tagTable and tagData */
/*
 * Data that follows is of the form
 *
 * icTagtagTable[icAny];* The tag table
 * icInt8NumbertagData[icAny];* The tag data
 */
} icProfile;

/*--------------------------------------------------------------------------*/
#endif /* ICC_H */
```

Annex D : PostScript Level 2 Tags

These tags are provided in order to control exactly the PostScript Level 2 operations that should occur for a given profile. These tags are only valid for PostScript Level 2 (and conceivably future versions of PostScript) devices, and are not generally supported in PostScript Level 1 devices. In addition, some of the tags may correspond to PostScript operations that are not supported in all PostScript Level 2 devices. Using such tags requires first checking for the available operators. All operators described in the PostScript Language Reference Manual, second edition, are available on all PostScript Level 2 devices. Documentation for extensions to PostScript Level 2 are available through Adobe's Developer Support Organization. In addition, guidelines for PostScript compatibility with this profile format are available. For details of such operator support, compatibility guidelines, the PostScript Level 2 device independent color model, or other PostScript-related issues contact Adobe's Developer Support Organization.

In general, there is a straightforward relationship between the profile's header fields and tags, and these PostScript tags. It is anticipated that the various CMSs that support this profile format will also provide support for these optional PostScript tags. To verify such support contact the CMS vendors directly. In cases where such support is provided, and the desired model of operations is the same for PostScript processing as it is for CMS processing, these tags can be omitted, since all necessary information is in the profile itself. In the case where such CMS support is in question or processing different than that provided by an arbitrary CMS is desired, these tags can be populated to provide exact control over the PostScript processing. For example, if private tags are used in the profile to achieve a non-public type of processing on certain CMSs, such processing can be achieved on a PostScript device by populating the appropriate PostScript tags.

Some of the PostScript tags have a tag type of textType or uInt8Type. This choice is provided in order to match the properties of the communications channel to the data in these tags. Encoding the data in uInt8Type form is recommended to save memory and/or reduce transmission times. Applications and drivers may convert it to ASCII Coded PostScript, Binary Coded PostScript, or Token Binary Coded PostScript or leave it in binary format to match the requirements of the communications channel. Applications and drivers are responsible for this potential conversion from binary data to channel compatible data. The data should be encoded in textType in those cases where the amount of data is relatively small or where the conversion from binary to channel compatible data is not available.

The PostScript contained in these tags is not self evaluating - it simply provides operands. These operands must be followed by operators like

setcolorspace, setcolorrendering, and findcolorrendering.

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Some of the PostScript tags have a tag type of dataType. This is to match the properties of the communications channel to the data in these tags. Encoding binary data in dataType is recommended to save memory and/or reduce transmission times. Applications and drivers may convert it to ASCII Coded PostScript, Binary Coded PostScript, or Token Binary Coded PostScript or leave it in binary format to match the requirements of the communications channel. Applications and drivers are responsible for this potential conversion from binary data to channel compatible data. The data should be encoded as ASCII in dataType in those cases where the amount of data is relatively small or where the conversion from binary to channel compatible data is not available.

The PostScript contained in these tags is not self evaluating - it simply provides operands. These operands must be followed by operators like setcolorspace, setcolorrendering, and findcolorrendering.

Annex E : Profile Connection Space Explanation

E.1 Introduction

This Appendix is intended to clarify certain issues of interpretation in the ICC Profile Format.

The goal of color management is to provide the capability of maintaining control over color rendering among various devices and media that may be interconnected through a computer system or network. To achieve this goal, the color characteristics of each device are determined and encapsulated in a *device profile*, which is a digital representation of the relation between device coordinates and a device-independent specification of color.

By *device coordinates* we mean the numerical quantities through which a computer system communicates with a color peripheral—such as the digital code values used to drive a monitor or printer, or the digital signals received from a scanner. These quantities are usually labeled *RGB* (or *CMYK*), but the labels identify the channels of the device rather than specific visual colors; the quantities are often encoded as unsigned 8-bit integers for each channel in the typical digital interface.

The *device-independent specification* is best given in a color space based on human visual experience. Thus, a device profile provides a means of translating (or transforming) color image data from device coordinates into a visual color space or vice versa.

Furthermore, if the various profiles available to a color-management system are referenced to the *same* visual color space, the system can translate data from one device's coordinates to another's—while maintaining color consistency—by (conceptually) passing through the intermediary of the visual color space; the latter, then, constitutes a standard interface for color communication, allowing profiles to be connected together in a meaningful sequence. A color space used in this way may be termed a *Profile Connection Space* (PCS). For example, the transformation of a color image from a scanner into monitor coordinates can be described as a transformation into the PCS (via the scanner's device profile) followed by a transformation out of the PCS (via the monitor's device profile). In practice, these successive transformations may be implemented in a variety of ways, and the image may never actually be represented in the PCS on disk or in computer memory. Thus, the PCS is to be regarded as a convenient reference for the definition of profiles—as an intermediate, or virtual, stage of the image processing—, in contrast to an *interchange* or *exchange color space*, which is an encoding for the storage and transmission of color images. The issues regarding the choice or design of a PCS are somewhat different from those related to an interchange space; this

Appendix is concerned only with PCS issues.

A PCS consists of a coordinate system for color space and an interpretation of the data represented in that coordinate system. In fact, multiple coordinate systems can easily be supported in the same or different color-management systems, as long as they share a common interpretation, since it is usually a well-defined and relatively simple mathematical task to transform from one coordinate system to another. However, if the interpretation of the represented colors is different, there may be no satisfactory way of translating the data from one to another.

The purpose of this paper is to present an unambiguous interpretation for the PCS implicit in the ICC Profile Format. It is especially important in the heterogeneous environments currently found on desktop platforms and networks to establish this interpretation in an open, non-proprietary specification, so that different color-management systems can communicate with each other and exchange profiles within and across platforms and operating systems.

E.2 Colorimetry and Its Interpretation

The issue of interpretation has received little attention in the recent past, because it has been widely believed that the choice of a suitable coordinate system—preferably one founded on *CIE colorimetry*, a system of measurement and quantification of visual color ~~stimuli~~ created and promoted by the *Commission Internationale de l'Éclairage*—would suffice to guarantee device independence. The notion was that colorimetric matching of the renderings on various media was the key to satisfactory color reproduction, and that interpretation was not needed. However, although colorimetry can be an essential element of a successful approach to color management, it is usually necessary to modify the colorimetric specification for renderings on different media.

Different media require different physical color stimuli, in certain cases, because they will be viewed in different environments—e.g., different surround conditions or illuminants; the observers, therefore, will experience different adaptive effects. In order to preserve the same *color appearance* in these different environments, the colorimetry must be corrected to compensate for the adaptation of the human visual system and for physical differences in the viewing environments, such as flare. Although color appearance is still an active research topic, the most common forms of adaptation are understood reasonably well, so that the required corrections in the colorimetry for different viewing conditions can be modeled with sufficient accuracy.

There are other reasons why the colorimetry may be altered for specific media. For instance, hard-copy media—*even those intended for the same viewing conditions*—differ considerably in their dynamic range and color gamut. A well-

crafted rendering of an image on a specific medium will take advantage of the capabilities of that medium without creating objectionable artifacts imposed by its limitations. For instance, the tone reproduction of the image should provide sufficient contrast in the midtones without producing blocked-up shadows or washed-out highlights. The detailed shape of the tone curve will depend on the minimum and maximum densities (Dmin and Dmax) attainable in the medium. Clearly, there is considerable art involved in shaping the tone-reproduction and color-reproduction characteristics of different media, and much of this art is based on subjective, aesthetic judgments. As a result, the substrate (paper, transparency material, etc.) and the colorants used in a medium will be exploited to impart a particular "personality" to the reproduction that is characteristic of the medium.

Furthermore, the desired behavior of a color-management system depends strongly on artistic intent. If the output medium is identical to the input medium—say, 35-mm slides—, the desired behavior is typically to create a duplicate of the original. But if the two media are different, it is not so obvious what the default behavior should be. In some cases, the intent may be to retain all or part of the personality of the original; in other cases, it may be more important to remove the personality of the original and replace it with a fresh rendering that has the full personality of the output medium. Sometimes the simulation of a third medium may be important—as when an image is displayed on a monitor to preview a rendering on a dye-diffusion printer, retaining (as well as possible) the personality of an original image scanned from a photographic print! It is essential to the success of color-management systems that a broad range of options be kept open. The interpretation of the PCS merely defines the particular default behavior that will be facilitated by the system without explicit intervention by the application or user. Alternative behaviors are not excluded by this choice; they simply will not be the default and will require more work.

With this context in mind, we present the following interpretation:

The PCS represents desired color appearances.

Here, the term *desired* is used to indicate that the interpretation is oriented towards colors to be produced on an output medium. It also is used to imply that these colors are not restricted by the limitations of any particular output medium. It is helpful here to conceptualize a "reference reproduction medium", with a large gamut and dynamic range, as the target medium for the desired colors. Consequently, it is the responsibility of the output device profiles to clip or compress these colors into the gamut of the actual output media. And, of course, "desired" also implies the expression of artistic intent.

The term *color appearance* is used to imply that adaptive effects are taken into account. Associated with the reference reproduction medium is a "reference viewing environment". More precisely, therefore, the PCS represents the "desired color appearances" in terms of *the CIE colorimetry of the colors to be rendered on the reference medium and viewed in the reference environment.* Output profiles for media that are viewed in different environments are responsible for modifying the colorimetry to account for the differences in the observer's state of adaptation (and any substantial differences in flare light present in these environments), so that color appearance is preserved. Similarly, input profiles are responsible for modifying the colorimetry of the input media to account for adaptation and flare; they also have the responsibility to account for the artistic intent implicit in the word "desired".

We define the *reference reproduction medium* as an idealized print, to be viewed in reflection, on a "paper" that is a perfect, non-selective diffuser (i.e., Dmin = 0), with colorants having a large dynamic range and color gamut. We define the *reference viewing environment* to be the standard viewing booth (ANSI PH-2.30); in particular, it is characterized by a "normal" surround—i.e., where the illumination of the image is similar to the illumination of the rest of the environment—, and the adapting illuminant is specified to have the chromaticity of D50 (a particular daylight illuminant).

E.3 Color Measurements

The PCS, so interpreted, represents colors for a hypothetical reference medium; device profiles must relate these colors to those that can be measured on real media. For consistency of results, these measurements must be made in accordance with the principles of CIE colorimetry.

For one particular class of media—namely, those intended for the graphic arts—, the colorimetry should conform to graphic-arts standards for color measurement.[1] Here, the illuminant is specified to be D50, so that no corrections need to be applied for chromatic adaptation. The colorimetry standard is based on a theoretical D50 illuminant, as defined by the CIE in the form of a tabulated spectral distribution. However, the fluorescent D50 simulators found in typical professional viewing booths have rather different spectral distributions, and the color stimuli produced can be noticeably different.[2] Often, better results can be obtained by basing the colorimetry on the actual, rather than the theoretical, illumination source; unfortunately, there is no standardized, practically realizable source.

1. IT8.7/3, "Graphic technology—Input data for characterization of 4-color process printing", draft standard of Subcommittee 4 (Color) of ANSI Committee IT8 (Digital Data Exchange Standards), 14 December 1992, Paragraph 4.2.

2. D. Walker, "The Effects of Illuminant Spectra on Desktop Color Reproduction", in *Device-Independent Color Imaging*, R. Motta and H. Berberian, ed., *Proc. SPIE*, 1909, 1993, pp. 236–246.

For other, non-graphic-arts, media, the illuminant may be different from D50. In general, for best results, the actual illumination spectrum should be used in the color measurements. And if the chromaticity of the illuminant is different from that of D50, corrections for chromatic adaptation will be needed and will be incorporated into the device-profile transforms. This aspect of the PCS interpretation provides flexibility to the color-management system. For example, it will be possible to transform data from a medium intended for tungsten illumination to a medium intended for cool-white-fluorescent: the input profile handles the adaptation from tungsten to D50, and the output profile handles the adaptation from D50 to cool-white.

Since substantial flare (perhaps 2–3%) may be present in an actual viewing environment,[1] the colorimetry is defined in an ideal, flareless measurement environment; in this way, difficult telescopic color measurements in the viewing environment can be avoided, and simple contact instruments and/or controlled laboratory conditions can be used instead. (Corrections should be applied to the data for any appreciable flare in the actual measurement environment and instruments.)

E.4 Colorimetry Corrections and Adjustments in Output Profiles

The implications of this interpretation should be emphasized: the creator of a profile is obliged to correct and adjust the PCS data for various effects. Since the PCS is interpreted with an output orientation, we will first examine the nature of these corrections and adjustments for output profiles. Then, in the next section, we will discuss the consequences for input profiles.

Let us look at a number of possible output paths:

E.5 Output to reflection print media

Included here are computer-driven printers, off-press proofing systems, offset presses, gravure printing, photographic prints, etc. These are generally intended for "normal" viewing environments; but corrections may be needed—e.g., for chromatic adaptation, if the illuminant's chromaticity is other than that of D50.

In the simplest scenario, the user desires to reproduce colors colorimetrically (aside from adaptive corrections) so as to attain an appearance match. A distinction can be made between "absolute" and "relative" colorimetry in this context. *Absolute* colorimetry coincides with the CIE system: color stimuli are referenced to a perfectly reflecting diffuser. All reflection print media have a reflectance less than 1.0 and cannot reproduce densities less than their particular Dmin. In a cross-rendering task, the choice of absolute colorimetry leads to a

1.R.W.G. Hunt, *The Reproduction of Colour*, Fourth Edition, Fountain Press, 1987, pp. 52–53.

close appearance match over most of the tonal range, but, if the Dmin of the input medium is different from that of the output medium, the areas of the image that are left blank will be different. This circumstance has led to the use of *relative* colorimetry, in which the color stimuli are referenced to the paper (or other substrate). This choice leads to a cross-rendering style in which the output image may be lighter or darker overall than the input image, but the blank areas will coincide. Both capabilities must be supported, since there are users in both camps. However, the default chosen for ICC is relative colorimetry.

This can be made more precise: the default "colorimetric" transform will effectively apply a scaling operation in the CIE 1931 XYZ color space:

$$X_a = (X_{mw} / X_i)\, X_r \quad \text{(EQ 1)}$$

$$Y_a = (Y_{mw} / Y_i)\, Y_r \quad \text{(EQ 1)}$$

$$Z_a = (Z_{mw} / Z_i)\, Z_r \quad \text{(EQ 3)}$$

where $XYZi$ are the coordinates of a color in the PCS, $(XYZ)a$ are the coordinates of the corresponding color to be produced on the output medium, $(XYZ)i$ are the coordinates of the lightest neutral represented in the PCS (namely, one with the chromaticity of D50 and a luminance of 1.0), and $(XYZ)mw$ are the coordinates of the output paper (or other substrate) *adapted to the PCS illuminant* (D50). Thus, the lightest neutral in the PCS will be rendered as blank paper—regardless of the reflectance or color cast of the paper—; other neutrals and colors will be rescaled proportionately and will be rendered darker than the paper. Output on different reflection print media will then agree with the PCS and with each other in relative colorimetry and, therefore, in relative appearance.

In other cases, the preference may be for absolute colorimetry. This means that, within the limitations of the output medium, the CIE colorimetry of the output image should agree with values represented in the PCS. I.e., $X_{out} = X$, $Y_{out} = Y$, and $Z_{out} = Z$. One way of achieving this result is to apply a separate transformation to the PCS values, outside of the device profile (e.g., in application or system software):

$$X' = (X_{D50} / X_{paper})\, X \quad \text{(EQ 4)}$$

$$Y' = (Y_{D50} / Y_{paper})\, Y \quad \text{(EQ 5)}$$

$$Z' = (Z_{D50} / Z_{paper})\, Z \quad \text{(EQ 6)}$$

The relative values, X' Y' Z', can then be processed through the default colorimetric transform (i.e., they are effectively substituted for XYZ in Equations 1–3) to achieve the desired result.

This capability depends on the availability to the color-management software of the colorimetry of the paper. The mediaWhitePointTag in the profile can be used for this purpose and should represent the adapted, absolute colorimetry of the lightest neutral that the device and/or medium can render

(usually the blank substrate).

In either case, it may happen that the dynamic range and/or color gamut of the output medium is not sufficient to encompass all the colors encoded in the PCS. Some form of clipping will then occur—in the highlights, in the shadows, or in the most saturated colors. While an appearance match may be achieved over much of color space, there will be a loss of detail in some regions. If this is objectionable, the operator should have an option for selecting a more explicit form of gamut compression to be applied to the colors as part of the output profile. ICC supports two styles of controlled gamut compression—"perceptual" and "saturation"—in addition to the "colorimetric" option, which clips abruptly at the gamut boundary. (An important case requiring explicit gamut compression is that of input from a transparency, where the dynamic range, even of the corrected colors, may exceed that of any reflection print medium.) Note that an explicit compression maps colors from the dynamic range and gamut of the reference medium to the range and gamut of the actual medium, so that only (XYZ)D50—i.e., the lightest PCS neutral—will be rendered as blank paper, just as in the relative-colorimetric case. This time, however, the entire tone scale may be readjusted, to keep the shadows from blocking up and to maintain proper midtones, and some in-gamut colors may be adjusted to make room for out-of-gamut colors.

E.6 Output to transparency media

This category might include overhead transparencies and large-format color-reversal media, as well as slide-production systems. Transparency materials are normally intended to be viewed by projection (using a tungsten lamp) in a dim or darkened room; in some cases, however, they are placed on a back-lit viewer for display, and in others they are used as a graphic-arts input medium, in which case they are examined on a light box or light table with the aid of a loupe. Accordingly, there are several possible viewing conditions for transparencies, requiring somewhat different corrections.

Typical color-reversal films have a much larger dynamic range than reflection media and higher midscale contrast. Their tone-reproduction characteristics have evolved empirically, but it may be plausible to explain them as partially compensating for dark-surround adaptation and the flare conditions typical in a projection room. The state of brightness adaptation in a projection room is also different from that in a reflection environment. To the extent that these explanations are valid, the colorimetry should be corrected for these effects. Furthermore, in some of these environments the visual system is partially adapted to a tungsten source, and chromatic corrections should be applied for the difference between tungsten and D50.

A "colorimetric" rendering, in this case, will actually produce an appearance match to the colors in the PCS, rather than a colorimetric match—

i.e., the colors measured on the resulting transparency will differ from those encoded in the PCS, but will appear the same *when the transparency is viewed in its intended environment* as the PCS colors would if rendered on the reference medium and viewed in reflection.

Note that the lightest neutral, (XYZ)D50,will be rendered at or near Dmin of the transparency in the default (relative) colorimetric transform. An absolute-colorimetric rendering can be generated in software, as described above for reflection-print media.

Explicit gamut compression can be provided as an option; it normally would not be needed for images input from photographic media, but it may be useful for input from computer graphics, since some of the highly saturated colors available on a computer color monitor fall outside the gamut of transparency media.

E.7 Negative media

Here the target colors are those of a reflection print to be made from the negative. No adaptive corrections are required, unless the print is intended to be viewed under an illuminant other than D50. Explicit gamut compression is a useful option, and both relative and absolute colorimetric matches can be provided as in the case of direct-print media.

Monitor display

The viewing conditions of a CRT monitor may require some corrections to the colorimetry, due to the effects of surround and flare. Also, if the monitor's white point is other than D50, chromatic adaptation must be accounted for. When corrections for these effects are applied, the colors in the display should match the appearance of those in the PCS and should provide accurate and useful feedback to the operator.

In most cases, the rendering should be "colorimetric" (possibly including adaptive corrections), in order to achieve this result. (As for reflection print media, this would be "relative" by default, but "absolute" colorimetry is also supported.) In other cases (video production, perhaps), it may be more important to the user to create a pleasing image on the monitor (without having out-of-gamut colors block up, for instance) than to preserve an appearance match to the PCS; for that purpose, explicit gamut compression would be a useful option.

In many scenarios, the monitor display is not the end product, but rather a tool for an operator to use in controlling the processing of images for other renderings. For this purpose, it will be possible to simulate on the monitor the colors that would be obtained on various other output media. The PCS colors are first transformed into the output-device coordinates, using any preferred style of gamut compression. Then they are transformed back to the PCS by using the (colorimetric) inverse output transform. (These two steps can be replaced by an equivalent "preview" transform.) Finally they are transformed (colorimetrically) into monitor coordinates for previewing. The result of compression to

the output gamut should then be visible in the displayed image.

E.8 Colorimetry Corrections and Adjustments in Input Profiles

The purpose of an input profile is to transform an image into the PCS—i.e., to specify the colors that are desired in the output. Since there are many possible intentions that a user might have for these colors, we cannot impose many restrictions on the nature of the transforms involved. Bearing in mind the capabilities of the output profiles, as just outlined, we can suggest the possibilities available to various classes of input profiles.

E.9 Scanned reflection prints

Here the intended viewing environment may be identical to the reference, but, if not, adaptive corrections should be applied to the colorimetry. In the simplest case, the profile may consist of a transformation from scanner signals to the colorimetry of the medium. In this case, the personality of the input medium has been preserved. If the output rendering is also "colorimetric", the result will be an appearance match to the original. Indeed, if the output medium is the same as the input medium, the result should be a close facsimile or duplicate of the original.

By default, the rendering is based on relative colorimetry, as discussed above. Therefore, it should be remembered, when creating an input profile, that the (*XYZ*)D50 point of the PCS will be mapped to the *Dmin* of the output medium. This implies that the *Dmin* of the input medium must be mapped to the (XYZ)D50 point of the PCS, in order to facilitate the duplication of an original and a relative-colorimetry match when cross-rendering.

In order to enable the alternative of absolute colorimetry, the "white point" field in the header of the input profile should be used to specify the colorimetry of the paper. This allows the absolute colorimetry of the original to be computed from relative colorimetry represented in the PCS, by analogy to Equations 1–3 above. These absolute color stimuli can then be converted to relative colorimetry for output by using the "white point" field of the output profile in Equations 4–6.

There are other possibilities, however. The input profile could be designed to remove some or all of the personality of the input medium, so that the PCS encoding makes use of more of the gamut and dynamic range of the reference medium. In these cases, it will probably be best to choose some form of explicit gamut compression in the output profile. The result may differ in appearance considerably from the original and will constitute a fresh rendering tuned to the capabilities and limitations of the output medium.

In any case, a calibrated color monitor, if available, can be used to display

an accurate preview of the result.

E.10 Scanned transparencies

Since transparencies are intended for viewing in a variety of environments, different kinds of adaptive corrections may be applied to the colorimetry of the input medium to obtain colors in the PCS. For instance, the device profile might transform scanner signals into the colorimetry of a reference print that would have the same appearance in the reference environment as the transparency produces in a projection environment. (Note that there may be no actual reflection print medium that has sufficient dynamic range to reproduce all of these color appearances). In this scenario, the personality of the color-reversal film or other transparency material is retained, even though the colorimetry has been modified for the PCS; still, this may be loosely termed a "colorimetric" transform, since the only corrections are for flare and adaptation.

As in the case of input prints, there are other possibilities: some or all of the personality of the input medium can be removed, according to artistic intent, yielding different results, which also depend on the style of gamut compression selected for output.

Normally, the *D*min of the input medium should be mapped to (*XYZ*)D50 in the PCS. The absolute, adapted *XYZ* of the *D*min color is recorded in the "medium white point" tag.

E.11 Scanned negatives

Photographic negatives, of course, are not intended for direct viewing. Therefore, the colorimetry that is relevant here might be that of a hypothetical reflection print made from the negative and intended for viewing in the reference environment. No adaptive corrections should be applied. The personality of the result is that of the negative-positive system as a whole. Again, other possibilities exist, depending on artistic intent.

Computer graphics

Such imagery is usually synthesized in the *RGB* space of a display monitor that provides visual feedback to the operator. Thus, adaptive corrections may need to be applied to the colorimetry of the monitor to define the colorimetry of a reference print having the same appearance.

The personality here is that of the synthetic image on the monitor screen.

E.12 Scene capture

This pathway refers to video cameras, electronic still cameras, and other

technologies (such as Photo CD™) that provide a capability of approximately determining the colorimetry of objects in a real-world scene. In most cases, the tone scale must be adjusted to provide enough contrast for viewing the reference medium in the reference environment; the colorfulness of the image should also be enhanced somewhat for that environment. The personality of the result, of course, depends on the nature of these adjustments.

E.13 Colorimetric input

In some cases, input colors are specified that are intended to be processed colorimetrically, without any tone shaping or chromatic enhancement. This might be the case, for instance, when a scene-capture device is used to record the colorimetry of real-world objects for scientific reasons, rather than for creating a pleasing reproduction. It may also be the case when particular spot colors are specified in colorimetric terms. In these cases, the specified colorimetric values are left intact in the transformation to the PCS; no adaptive corrections or adjustments are applied. The PCS values should be represented in relative colorimetry, and the "white point" tag specifies the reference point for the scaling. In some cases this reference point will have a luminance of 1.0, and there will be no difference between relative and absolute colorimetry. In other cases the reference point will have the colorimetry of (say) the paper stock used in a spot-color sample book or of a particular light neutral in a scene. In most of these cases, the preferred output rendering will also be "colorimetric". By default, as before, this will entail relative colorimetry; absolute colorimetry can be achieved, outside of the default transforms, by taking account of the "white point" tags of the input and output profiles and converting appropriately.

An image of this kind can be said to have no personality.

As can be inferred from some of these examples, the user may have a choice of input profiles having different intents, as well as a choice among output transforms having different intents. The end result depends on both of these choices, which, for the most predictable color reproduction, should be made in coordination. To aid in this coordination, there are profile tags that specify the rendering intent and that distinguish between input transforms that are colorimetric (aside from possible corrections for flare and adaptation) and those that have applied adjustments to the colorimetry.

E.14 Techniques for Colorimetry Corrections

As we have seen, if the viewing conditions of the medium are different from the reference (e.g., projected slides or video viewed in dim or dark surround), corrections to the colorimetry of the reproduction should be applied.[1] These

1. Hunt, *op. cit.*, pp. 56–61.

John J. Edmonds (State Bar No. 274200)
jedmonds@cepiplaw.com
COLLINS EDMONDS POGORZELSKI
SCHLATHER & TOWER, PLLC
1851 East First Street, Suite 900
Santa Ana, California 92705
Telephone: (951) 708-1237
Facsimile: (951) 824-7901

Attorney for Plaintiff,
DIGITECH IMAGE TECHNOLOGIES, LLC

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) STATEMENT OF GENUINE DISPUTES OF MATERIAL FACT FOR PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) STATEMENT OF GENUINE DISPUTES OF MATERIAL FACT FOR PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO.

	6,128,415 UNDER 35 U.S.C. 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION ET AL., Defendant(s).	CASE NO. SACV 12-01681-ODW (MRWx) STATEMENT OF GENUINE DISPUTES OF MATERIAL FACT FOR PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01689-ODW (MRWx) STATEMENT OF GENUINE DISPUTES OF MATERIAL FACT FOR PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01694-ODW (MRWx) STATEMENT OF GENUINE DISPUTES OF MATERIAL FACT FOR PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. 101 Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

Pursuant to Federal Rule of Civil Procedure 56 and Local Rule 56-2, Plaintiff Digitech Image Technologies LLC ("Digitech") respectfully submits the following STATEMENT OF GENUINE DISPUTES OF MATERIAL FACT PLAINTIFF'S RESPONSE TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. 101, setting forth the material facts as to which it is contended there exists a genuine dispute necessary to be litigated.

Dated: July 10, 2013

Respectfully submitted,

COLLINS, EDMONDS, POGORZELSKI,
SCHLATHER & TOWER, PLLC

/s/ *John J. Edmonds*
John J. Edmonds
State Bar No. 274200
Stephen F. Schlather
(Admitted Pro Hac Vice)

Attorneys for Plaintiff
DIGITECH IMAGE TECHNOLOGIES LLC

DISPUTED MATERIAL FACTS

I. DISPUTED MATERIAL FACTS AS TO WHICH THERE EXISTS A GENUINE DISPUTE NECESSARY TO BE LITIGATED.

1. There is a genuine factual dispute over whether claims 1-6, 9-15 and 27-31 (the "Asserted Claims) of U.S. Patent No. 6,128,415 (the "'415 patent"), as a whole, claim or merely entail or describe an abstract idea.

2. There is a genuine factual dispute over whether the "device profile" of the Asserted Claims of the '415 patent is or merely entails or describes an abstract idea.

3. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent claim contain limitations that meaningfully tie any alleged abstract idea to an actual application of that idea through meaningful limitations.

4. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent claim cover all practical applications of (i.e., pre-empt) an abstract idea.

5. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent contain only insignificant or token pre- or post-solution activity.

6. There is a genuine factual dispute over whether the Asserted Claims of the '415 patent provide real direction, cover all possible ways to achieve the provided result, or are overly-generalized.

7. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent tie an allegedly abstract idea to a specific way of doing something with a computer, or a specific computer for doing something.

8. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent entail a computer being part of the solution, being integral to the performance of the method, or containing an improvement in computer technology.

9. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent comprise inventions with specific applications or improvements to technologies in the marketplace.

10. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent comprise functional and palpable applications in the field of computer imaging technology.

11. There is a genuine factual dispute over whether the “device profile” in the Asserted Claims of the ‘415 patent tangibly exists as an integral part of the design and calibration of a processor device within a digital image processing system.

12. There is a genuine factual dispute over whether the “device profile” in the Asserted Claims of the ‘415 patent tangibly exists as a “tag” appended to or embedded in a digital image obtained using a digital image processing system.

13. There is a genuine factual dispute over whether there are a myriad of methods to accomplish device profiles besides as claimed in the Asserted Claims of the ‘415 patent.

14. There is a genuine factual dispute over whether there are a myriad of methods to accomplish digital image processing besides as claimed in the Asserted Claims of the ‘415 patent.

15. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent cover all possible ways to achieve the provided result.

16. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent are tied to specific way of doing something with a computer (i.e., a specially programmed processor within a digital imaging system).

17. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent are tied to special purpose computer, i.e., a digital image processor or controller, is part of the solution, being integral to the performance of the method.

18. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent contain an improvement over prior digital image processing technology.

19. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent amount to nothing more than adding data derived from mathematical equations to a well-known and existing file structure

20. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent amount to nothing more than algorithms or data.

21. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent comprise transient propagating forms of signal transmission.

22. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent nothing more than the manipulation of basic mathematical constructs

23. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent could be practiced as mental steps.

24. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent could be practiced on a piece of paper.

25. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent highly generalized.

26. There is a genuine factual dispute over whether the Asserted Claims of the ‘415 patent specific elements in the claims that limit any abstract concept within the scope of the invention.

27. There is a genuine factual dispute over whether the matters claimed by the Asserted Claims of the ‘415 patent are inherent in the idea of digital image processing.

28. There is a genuine factual dispute over whether the matters claimed by the Asserted Claims of the ‘415 patent are disassociated with any specific application of an apparatus or activity.

29. There is a genuine factual dispute over whether the device profile of the ‘415 patent is a machine.

30. There is a genuine factual dispute over whether the device profile of the ‘415 patent is a manufacture.

31. There is a genuine factual dispute over whether the device profile of the ‘415 patent is a composition of matter.

32. There is a genuine factual dispute over whether the asserted method claims of the ‘415 patent (i.e. claims 10-15) (the “Asserted Method Claims”) are tied to a particular machine or apparatus, for example the apparatuses in a digital processing system comprising a processor or controller.

33. There is a genuine factual dispute over whether the Asserted Method Claims of the ‘415 patent are tied to a particular machine or apparatus (see above) such that it imposes impose meaningful limits on the claim’s scope.

34. There is a genuine factual dispute over whether the Asserted Method Claims of the ‘415 patent transform a particular article, namely a digital image, into a different state or thing, namely a digital image with distortions ameliorated or corrected.

PROOF OF SERVICE

The undersigned certifies that counsel of record who are deemed to have consented to electronic service are being served on September X, 2012 with a copy of this document via the Court's CM/ECF system per the Local Rules. Any other counsel will be served by electronic mail, facsimile, overnight delivery and/or first class mail on this date.

/s/ John J. Edmonds
John J. Edmonds

CHRISTOPHER P. BRODERICK
cbroderick@orrick.com
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: 213-629-2020
Facsimile: 213-612-2499

Attorneys for Defendants

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) **DEFENDANTS' NOTICE OF MOTION AND MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) **DEFENDANTS' NOTICE OF MOTION AND MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION and SIGMA CORPORATION OF AMERICA, Defendants.	CASE NO. SACV 12-01681-ODW (MRWx) **DEFENDANTS' NOTICE OF MOTION AND MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01689-ODW (MRWx) **DEFENDANTS' NOTICE OF MOTION AND MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01694-ODW (MRWx) **DEFENDANTS' NOTICE OF MOTION AND MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

TO THE COURT, ALL PARTIES, AND THEIR ATTORNEYS OF RECORD:

PLEASE TAKE NOTICE THAT Defendants FUJIFILM Corporation, Sigma Corporation, Sigma Corporation of America, Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., Ricoh Americas Corp., and Konica Minolta Business Solutions, U.S.A., Inc., (collectively "Defendants"), hereby move the Court for DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101. Pursuant to this Court's order (Dkt. 63 in the consolidated case), the motion will be heard on July 29, 2013, at 1:30 p.m., in Courtroom 11, before the Honorable Otis D. Wright, II.

Dated: July 3, 2013 Orrick, Herrington & Sutcliffe LLP

By: */s/ CHRISTOPHER P. BRODERICK*
CHRISTOPHER P. BRODERICK

Attorney for Defendants

FUJIFILM Corporation, Sigma Corporation, Sigma Corporation of America, Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., Ricoh Americas Corp. and Konica Minolta Business Solutions, U.S.A., Inc.

CHRISTOPHER P. BRODERICK
cbroderick@orrick.com
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: 213-629-2020
Facsimile: 213-612-2499

Attorneys for Defendants

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

WESTERN DIVISION

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) **MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION and SIGMA CORPORATION OF AMERICA, Defendants.	CASE NO. SACV 12-01681-ODW (MRWx) **MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC,

Plaintiff,

v.

PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP.,

Defendants.

CASE NO. SACV 12-01689-ODW (MRWx)

MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101

Judge: Hon. Otis D. Wright, II

Hearing Date: July 29, 2013
Hearing Time: 1:30 p.m.
Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC,

Plaintiff,

v.

KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC.,

Defendants.

CASE NO. SACV 12-01694-ODW (MRWx)

MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101

Judge: Hon. Otis D. Wright, II

Hearing Date: July 29, 2013
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I. PRELIMINARY STATEMENT

Defendants move this Court for an order granting summary judgment that every asserted claim of United States Patent No. 6,128,415 ("the '415 patent") is invalid under 35 U.S.C. § 101. Section 101 restricts patentable subject matter to four categories: "process, machine, manufacture or composition of matter." None of the asserted claims is within any of the four allowable subject matter categories, and therefore each claim is invalid.

Each of the '415 patent claims is explicitly directed to data, generating data, or mathematical algorithms (*e.g.*, claim 1: "A device profile…consisting of: first data…and second data….).[1] The law is clear—mere data, data gathering, and mathematical algorithms are not patentable, because they are not within any of the four allowable subject matter categories.[2]

Moreover, even assuming *arguendo* that any of the '415 patent claims fall within one of the four allowable subject matter categories (which they do not),

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[1] *See* '415 patent at 5:33-41 (column 5, line 33-41.) The '415 patent is attached as Exhibit A to the concurrently filed Declaration of Andrew Y. Yen in Support of Defendants' Motion for Summary Judgment of Invalidity of U.S. Patent No. 6,128,415 Under 35 U.S.C. § 101 ("Yen Decl."). All Exhibits referenced in the moving papers are attached to the Yen Decl.

[2] *See In re Grams*, 888 F.2d 835, 840 (Fed. Cir. 1989) (data-gathering steps "cannot make an otherwise non-statutory claim statutory"); *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1333 (Fed. Cir. 2012) (claimed process of receiving and forwarding data invalid); *CyberSource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1370 (Fed. Cir. 2011) (mere "[data-gathering] step[s] cannot make an otherwise non-statutory claim statutory" and affirming district court's holding that a claim that requires one to "obtain and compare intangible data" is invalid under 101); *Bancorp Serv. v. Sun Life Assurance Co.*, 687 F.3d 1266, 1279-81 (Fed. Cir. 2012) (holding claims for merely "determining values… then 'storing' 'removing' and/or 'accumulating' some of those values" invalid); *Sinclair-Allison, Inc. v. Fifth Ave. Physician Serv.*, No. CIV-12-360-M, 2012 WL 6629561 at *4 (W.D. Okla. Dec. 19, 2012) ("[P]atent claims [that] simply explain the basic concept of compiling data and recycling it for different purposes" are invalid.).

those claims are still invalid, because they recite nothing more than abstract ideas. The Supreme Court enumerated three specific exceptions to what is patentable ("laws of nature," "physical phenomena," and "abstract ideas"), even if a claim is within one of the four categories of §101.[3] The '415 patent clearly claims unpatentable abstract ideas. Indeed, the named inventors themselves told the PTO that the claimed device profile was an "abstract description." (UF 14).

The patent examiner did not address the threshold requirements for patentability under §101 during prosecution of the '415 patent. In recent years, the Board of Patent Appeals and Interferences (BPAI) has found numerous claims unpatentable under §101 where, as here, the issue was not raised by the examiner.[4]

Patent eligibility under §101 is a threshold legal issue which may be decided early and independent of other statutory requirements for patentability.[5] It is appropriate for this Court to consider §101 at an early stage of the litigation because it does not require discovery, expert testimony, or claim construction. The Supreme Court recently held that "to shift the patent-eligibility inquiry entirely to … later

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[3] *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).

[4] Patent examiners routinely miss §101 rejections. *See, e.g.*, *Ex Parte Asare*, No. 2009-007451, 2010 Pat. App. LEXIS 17827 (B.P.A.I. Nov. 17, 2010). The patent examiner in *Ex Parte Asare* rejected the claims as anticipated under §102, but made no §101 rejections. On appeal, the BPAI "vacate[d] the prior art rejection…because we conclude that all claims…are 'barred at the threshold by §101.'" Attached as Exhibit C to the Yen Decl. is a list of fifteen recent examples of the BPAI issuing §101 rejections missed by patent examiners.

[5] *Bilski v. Kappos*, 130 S. Ct. 3218, 3225 (2010) ("*Bilski II*") ("The §101 patent-eligibility inquiry is only a threshold test. Even if an invention qualifies as a process, machine, manufacture, or composition of matter, in order to receive the Patent Act's protection the claimed invention must also satisfy 'the conditions and requirements of this title.' Those requirements include that the invention be novel, *see* §102, nonobvious, *see* §103, and fully and particularly described, *see §112*."). *In re Comiskey*, 554 F.3d 967, 975 (Fed. Cir. 2009) ("[W]hether asserted claims are invalid for failure to claim statutory subject matter under 35 U.S.C. § 101 is a question of law.").

sections [(*e.g.*, §§ 102, 103, or 112)] risks creating significant greater legal uncertainty."[6] Numerous courts have held patent claims invalid under §101 without claim construction,[7] including in opinions ruling on a Rule 12(b)(6) motion to dismiss.[8] None of the district court cases cited in Digitech's June 24, 2013 letter hold that claim construction is required prior to deciding invalidity under §101.[9] The only appellate decision cited by Digitech, *Bilski I*, was superseded by the Supreme Court's *Bilski II* decision, which invalidated the patent claims under §101 without claim construction.[10]

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[6] *Mayo Collaborative Serv. v. Prometheus Lab., Inc.*, 132 S.Ct. 1289, 1304 (2012).

[7] *Bancorp Serv. v. Sun Life Assurance Co.*, 771 F.Supp.2d 1054, 1059 (E.D. Miss., 2011), *aff'd*, 687 F.3d 1266 (Fed. Cir. 2012) ("[W]e perceive no flaw in the notion that claim construction is not an inviolable prerequisite to a validity determination under §101."); *Sinclair*, 2012 WL 6629561 at *2 ("[T]here is no requirement that claims construction be completed before examining patentability."); *CyberFone Sys. v. Cellco P'ship*, 885 F.Supp.2d 710, 715-719 (D. Del. 2012).

[8] *CyberFone*, 885 F.Supp.2d at 715-719; *Cardpool, Inc. v. Plastic Jungle, Inc.*, No. C 12-04182 WHA, 2013 WL 245026 (N.D. Cal. 2013); *Ultramercial, LLC v. Hulu, LLC*, 2010 WL 3360098 (C.D. Cal. Aug. 13, 2010), *rev'd on other grounds*, 657 F.3d 1323 (Fed. Cir. 2011).

[9] Dkt. No. 59 in Case No. cv-12-01324-ODW at page 1, ¶ 2 ("Digitech Letter"). *Prompt Medical v. Allscriptsmysis Healthcare*, No. 6:10-cv-71-LED, 2012 WL 678216, (E.D. Tex 2012) (The §101 motion was brought after claim construction); *LendingTree v. Zillow*, No. 3:10-cv-00439 (W.D.N.C. 2012) (court struck motion to dismiss because it did not, as counsel promised, deal with personal jurisdiction or comply the court's page limits); *Innovention Toys v. MGA Entertainment*, 2009 WL 424398 (E.D. La. 2009) (court considered the necessity of claim construction to decide invalidity under §§102 and 103, not §101); *H-W Technology v. Apple*, No. 3:11-CV-651-G (N.D. Tex. 2013) (considered indefiniteness under §112 and noninfringement under §271(a), not invalidity under §101); *Ass'n for Molecular Pathology v. USPTO*, 2010 U.S. Dist. LEXIS 35418, *92 (S.D.N.Y. 2010) (construed complex terms related to a person's predisposition to develop breast cancer as part of §101 analysis).

[10] *In re Bilski*, 545 F.3d 943, 964 (Fed. Cir. 2008) ("*Bilski I*"). *Ultramercial*, the case cited in Digitech's Letter at page 2, paragraph 3, for the proposition that

II. BACKGROUND OF THE TECHNOLOGY

The ‘415 patent describes data used in digital image processing systems. Digital imaging processing systems include devices such as cameras and scanners that capture digital images, and printers and monitors that reproduce digital images. ‘415 patent at 1:20-23.

According to the patent, all digital image processing devices introduce distortions because of the physical limitations of the devices. ‘415 patent at 1:32-34. Distortions can occur in the color of the image or in the spatial component of the image (the spatial component referring to the space or dimension of the image). (Exhibit B, ‘415 patent prosecution history, at 143.)

To reduce color distortions, digital image processing systems convert the digital image files between color spaces. A color space uses a set of numbers to identify a color as a combination of component colors. For example, the RGB color space (red-green-blue) often represents the quantity of each red, green and blue component using integers from 0 to 255.[11]

The ‘415 patent further asserts that all digital image processing devices also introduce spatial distortions in the digital image. ‘415 patent at 1:32-34. The spatial data describing the digital image includes the spatial distortions. According to the named inventors, spatial data includes data related to real space coordinates and an example of a spatial operation is digital zoom.[12]

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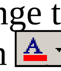
§101 was merely a “threshold test” held that since §101 was a “coarse filter,” “claim construction may not always be necessary for a § 101 analysis,” citing *Bilski II*. *Ultramerical, LLC v. Hulu, LLC*, 657 F.3d 1323, 1326 (Fed. Cir. 2011).

[11] For example, the text in this document was created in pure black using the r,g,b triplet 0,0,0. Text in pure red would have the r,g,b triplet 255,0,0. To change the font color in Microsoft Word, select the down arrow next to the font button , select “More Colors…,” “Custom,” set the “Color model” to “RGB,” and then set each of the r,g,b, values to any number from 0 to 255.

[12] ‘415 prosecution history, Yen Decl. at ¶ 4, Exhibit B, page 143.

The '415 patent is directed to spatial data. The inventors told the PTO that they invented a "device profile comprising data for describing spatial information of a device…in device independent space." (emphasis in original.) (UF 11).

Prior to the 1996 filing date of the '415 patent, the International Color Consortium (ICC) used a device profile.[13] The inventors' disclosed embodiment incorporated spatial characteristic functions into the existing ICC profile.

> In the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format…

Id. The '415 patent specification and claims disclose that spatial characteristic functions are mathematical equations. '415 patent at 3:12-5:9.

In other words, the alleged invention amounts to nothing more than adding data derived from mathematical equations to a well-known and existing file structure (*i.e.*, the ICC profile). Indeed, the inventors told the PTO that their alleged invention "provides the actual data which the spatial algorithm requires for processing." (UF 12, 13). The inventors also told the PTO that their "device profile" is an "abstract description of the spatial response properties…" (UF 14).

III. ARGUMENT

A. Legal Standards for Summary Judgment.

Summary judgment is appropriate when there is no genuine issue of material fact and the moving party is entitled to judgment as a matter of law.[14] Whether patent claims are invalid for failure to claim statutory subject matter under §101 is a

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[13] '415 patent at 5:10-15. The ICC Profile Specification is included in the '415 prosecution history, see Yen Decl. at ¶ 4, Exhibit B, pages 196-302.

[14] Fed. R. Civ. P. 56; *Celotex Corp. v. Catrett*, 477 U.S. 317, 322-23 (1986); *accord, e.g., Lakim Indus., Inc. v. Linzer Prods. Corp.*, Case No. 2:12-cv-04976-ODW-JEM, (C.D. Cal. Jan. 24, 2013); *Stamps.com, Inc. v. Endicia, Inc. et al.*, 2009 LEXIS 131104 (C.D. Cal. Nov. 9, 2009).

question of law and, therefore, well suited for summary judgment.[15]

B. All of the '415 Asserted Claims are Invalid under § 101.

1. The Asserted Claims.

The asserted claims can be divided into two groups.[16] Claims 1 and 26, and their dependent claims 2-6, 9 and 27-31, respectively, are directed to a device profile consisting of data ("Device Profile Claims"). Claim 10 and its dependent claims 11-15 are directed to generating a device profile ("Device Profile Generating Claims"). Each Device Profile Generating Claim requires manipulating gathered data (*i.e.*, measured chromatic stimuli and spatial stimuli) with device response characteristic functions (*i.e.*, mathematic constructs).

2. The Device Profile Claims are Invalid under § 101.

The Device Profile Claims are directed to a "device profile" comprised of data. (UF 2, 3, 11, 12, 13). While the "device profile" of claim 1 comprises "first data" and "second data," the device profile of claim 26 comprises a single set of data. Thus, by the language of the claims themselves, the claimed "device profile" comprises data. Because data is not a patent eligible subject matter under §101, all of the asserted claims are invalid for reciting patent ineligible subject matter.

a. A "device profile" does not fall within one of the four §101 patent eligible subject categories.

35 U.S.C. §101 defines four eligible patent subject categories:[17]

> Whoever invents or discovers any new and useful **process**, **machine**, **manufacture**, or **composition of matter**, or any new and useful

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[15] *See CyberSource*, 654 F.3d at 1369 (affirming summary judgment of invalidity of claims directed to a patent-ineligible abstract concept); *In re Comiskey*, 554 F.3d 967, 975 (Fed. Cir. 2009).

[16] Digitech is asserting claims 1-6, 9, 10-15 and 26-31. Yen Decl. at ¶ 6. Claims 1, 10 and 26 are the only asserted independent claims.

[17] *Bilski II*, 130 S. Ct. 3218, 3225 (2010) (emphasis added.)

> improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

These categories define the entire extent of patent eligible subject matter. If a claim is directed to subject matter outside the four statutory categories (process, machine, manufacture, or composition of matter) that claim is not patent eligible even if the subject matter is otherwise new and useful.[18] Because the Device Profile Claims are not directed to any of the four allowable categories they are not patent eligible.

<u>Not a process</u>. A process is an act, or a series of acts or steps.[19] The claimed "device profile" is data, it is not an act, or a series of acts or steps.

<u>Not a machine</u>. A machine is a concrete thing, consisting of parts, or of certain devices and combination of devices. It may include every mechanical device or combination of mechanical powers and devices to perform some function and produce a certain effect or result.[20] The claimed "device profile" is data. It is not concrete, and it consists of no tangible parts. It is neither a mechanical device nor a combination of mechanical powers and devices.

Digitech's Letter is wrong in asserting that *In re Nuijten* held that "software and data structures in tangible form can be considered either a manufacture or a machine."[21] Indeed, in *In re Nuijten*, the Federal Circuit affirmed the rejection of all of the claims under §101 and specifically held that the claims were "not a

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[18] *Mayo*, 132 S.Ct. at 1303-04; *In re Ferguson*, 558 F.3d 1359, 1365 (Fed. Cir. 2009).

[19] *See Gottschalk v. Benson*, 409 U.S. 63, 70 (1972) ("A process is a mode of treatment of certain materials to produce a given result. It is an *act*, or a *series of acts*, performed upon the subject-matter to be transformed and reduced to a different state or thing.") (emphasis added); *NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1316 (Fed. Cir. 2005) ("A process is a series of acts.").

[20] *Ferguson*, 558 F.3d at 1364 (quoting *In re Nuijten*, 500 F.3d 1346, 1365 (Fed. Cir. 2007)).

[21] Digitech Letter at page 5, second full paragraph.

'machine' as that term is used in §101," and "not 'manufacture[s]' under the meaning of that term in §101."[22]

Not a manufacture. A manufacture is "the production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations, whether by hand-labor or by machinery." [23] The claimed "device profile" is data. The device profile could be data written on a piece of paper. It is not a manufacture.[24] *See also In re Nuijten*.

Not a composition of matter. A composition of matter is all compositions of two or more substances and all composite articles, whether they be the result of chemical union or mechanical mixture, or whether they be gases, fluids, powders or solids.[25] The claimed "device profile" is data. It is not a composition of two or more gaseous, fluid, or solid substances.

Because the claimed "device profile" is not directed to a process, machine, manufacture, or a composition of matter, it falls outside the scope of §101.

b. A "device profile" is an unpatentable abstract idea.

Even if the Device Profile Claims could be fit within one of the four allowable subject matter categories, they are still invalid because they are directed to unpatentable abstract ideas. The Supreme Court enumerated three specific exceptions (laws of nature, physical phenomena, and abstract ideas) to what is patentable even if the claims are within the four categories of §101.[26]

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[22] *In re Nuijten*, 500 F.3d at 1357-58.

[23] *Diamond v. Chakrabarty*, 447 U.S. 303, 308 (1980).

[24] *In re Warmerdam*, 33 F.3d 1354, 1360-1362 (Fed. Cir. 1994) (holding that a claim directed to data is not patent eligible).

[25] *Chakrabarty*, 447 U.S. at 308.

[26] *Diamond v. Diehr*, 450 U.S. 175, 185 (1981) (citing *Benson*, 409 U.S. at 71-72); *Bilski II*, 130 S. Ct. at 3225 ("The Court's precedents provide thee specific exceptions to §101's broad patent-eligibility principles: 'laws of nature, physical phenomena, and abstract ideas.'") (citing *Chakrabarty*, 447 U.S. at 309.)).

Accordingly, the Device Profile Claims are directed to unpatentable abstract ideas. Mathematical constructs, such as equations or algorithms, are the paradigmatic abstract idea.[27] As discussed below, the claimed "device profile" merely recites data represented by mathematical equations or algorithms. (UF 8, 10, 18, 19). Further, the inventors unambiguously admitted to the PTO that the device profile of the claims was an "abstract description." (UF 14). Thus, the Device Profile Claims are unpatentable for reciting an abstract idea.[28]

The data comprising the "device profile" of the Device Profile Claims are wholly defined by mathematical equations or algorithms. The "first data" is "for describing a device dependent transformation of color information content of the image to a device independent color space." ('415 patent, claim 1.) The inventors told the PTO that this included mathematically transforming device dependent R, G, B values into device independent X, Y, Z values using the following well-known equation for this transformation (UF 17, 18, 19):

$$X = 2.769R + 1.752G + 1.130B$$
$$Y = 1.000R + 4.591G + 0.060B$$
$$Z = 0.000R + 0.057G + 5.593B$$

The "first data," therefore, is nothing more than a set of numbers generated by applying a well-known mathematical equation, the paradigmatic abstract idea.

The "second data" (*e.g.*, '415 patent, claim 1) is also defined by abstract equations or algorithms. For example, some of the dependent claims describe the second data as represented by a "characteristic function" "describing image signal transform characteristics." (UF 6). This "characteristic function" is just a

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[27] *Warmerdam*, 33 F.3d at 1360 ("These steps describe nothing more than the manipulation of basic mathematical constructs, the paradigmatic 'abstract idea.'").

[28] *Accenture Global Serv. v. Guidewire Software, Inc.*, 800 F.Supp.2d 613, 619 (D. Del. 2012).

mathematical formula. (UF 10).

$$M(u,v) = \langle M(x,y,u,v)\rangle_{xy}$$

> where the operation $\langle M(x,y,u,v)\rangle_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y.

Like the "first data," therefore, the "second data" of the device profile requires data generated by applying well-known mathematical equations and algorithms.

The Supreme Court has consistently held that claims to mathematical equations or algorithms are unpatentable under §101 because they are directed to abstract ideas.[29] The Supreme Court in *Flook* held that "if a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory."[30]

In addition, in *Warmerdam*, the Federal Circuit held unpatentable under §101 a claim directed to a data structure generated using methods that describe nothing more than the manipulation of abstract mathematical constructs.[31] The Device Profile Claims are equally, if not more, abstract as the data structure claim of *Warmerdam*, because they are directed merely to data represented by mathematical constructs.

3. The "Device Profile Generating Claims" also are invalid under §101.

The Device Profile Generating Claims, *i.e.*, claims 10-15, are directed to methods of generating a "device profile." The method of claim 10 involves three steps: 1) generating a first data; 2) generating a second data; and 3) combining the first and second data into a "device profile." '415 patent, claim 10. The first data is generated through use of measured chromatic stimuli and device response

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[29] *Benson*, 409 U.S. at 67-68.

[30] *Parker v. Flook*, 437 U.S. 584, 595 (1978) (*citing In re Richman*, 563 F.2d 1026, 1030 (C.C.P.A., 1977)).

[31] *Warmerdam*, 33 F.3d at 1360-62.

characteristic functions. *Id*. The second data is generated through spatial stimuli and device response characteristic functions. *Id*.

The inventors told the PTO that chromatic stimuli and spatial stimuli can be gathered using a measuring device such as a microdensitometer. (UF 15).[32] As discussed previously, the characteristic functions are merely mathematical formulas. *See* Section III.B.2.b., *supra*. Accordingly, the steps of generating first data and second data merely involve taking measurements and performing mathematical calculations to create the device profile data.

The assertion in Digitech's Letter that, because the Device Profile Generating Claims start with the phrase "A method…," they automatically qualify as a "process" under §101 is refuted by a review of the claims that the Federal Circuit and Supreme Court grappled with in *Bilski I* and *Bilski II*, which also started with the phrase "A method…"[33] Following *Bilski I* and *Bilski II*, the Device Profile Generating Claims are properly analyzed under the machine-or-transformation test. As discussed below, because they fail that test, the asserted claims are not a patent-eligible process under §101. They also are invalid as an abstract idea.

a. The "Device Profile Generating Claims" fail the machine-or-transformation test.

The Supreme Court has endorsed the machine-or-transformation test as a useful and important standard for determining whether some claimed inventions are patent-eligible processes under §101.[34] Accordingly, district courts apply this

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[32] See also the '415 prosecution history, Yen Decl. at ¶ 4, Exhibit B, pages 148 and 165 at item (1), discussing the use of a microdensitometer to make this measurement and the mathematical derivation of the Modulation Transfer Function (MTF) of '415 claims 2 and 12 (Fig. 12 on page 165).

[33] *Bilski I*, 545 F.3d at 949.

[34] *Bilski II*, 130 S.Ct. at 3227 (noting that "patents for inventions that did not satisfy the machine-or-transformation test were rarely granted").

standard to determine patent eligible subject matter.[35]

Under the machine-or-transformation test, a process is patent-eligible under §101 only if: (1) it is tied to a particular machine or apparatus; or (2) it transforms a particular article into a different state or thing.[36] In addition, the machine "must impose meaningful limits on the claim's scope."[37] In other words, the machine "must play a significant part in permitting the claimed method to be performed."[38] To satisfy the transformation prong of the machine-or-transformation test, the claimed process must transform a particular article into a different state or thing.

(1) The "Device Profile Generating Claims" fail the machine prong of the test.

The Device Profile Generating Claims fail the machine prong of the machine-or-transformation test because they are not tied to a machine that imposes meaningful limitations on the scope of the claims or play a significant part in permitting the claimed methods to be performed.

The preamble of claim 10 recites a "device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image." Thus, by its literal terms the method of claim 10 generates data about a device, but it does not encompass performing the claim steps using any particular machine. That is, the phrase merely describes the type of data the device profile contains, not any machine for its generation or ultimate use. Similarly, claim 10's recitation of "for describing a device dependent transformation of color information content of the image to a device independent color space…" and "for describing a device dependent transformation of spatial information content of the

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[35] *Cyberfone*, 885 F.Supp.2d at 717-719 (finding claims invalid under § 101 because they fail the machine-or-transformation test).

[36] *Accenture*, 800 F.Supp.2d at 619-20.

[37] *CyberSource*, 654 F.3d at 1369.

[38] *Id*. at 1375.

image in said device independent color space…" are statements that merely specify the content of the first and second data and indicate the pre-existing data and mathematical relationships used to generate the first and second data *i.e.*, what the first and second data represent numerically, without limiting the disclosed method to performance on any particular machine.

Because the Device Profile Generating Claims have no relationship whatsoever to any particular machine, they fail the machine prong of the machine-or-transformation test.

(2) The "Device Profile Generating Claims" fail the transformation prong of the test.

The Device Profile Generating Claims also fail the transformation prong of the machine-or-transformation test because the claimed method does not transform "a particular article into a different state or thing."[39] As noted above, the steps of generating first data and second data merely involve assembling the first and second data and indicate the pre-existing data and mathematical relationships used to generate the first and second data without the specification of any machine for doing so. It is well established that a data-gathering step cannot make an otherwise non-statutory claim statutory."[40]

In *Bilski I*, the Federal Circuit held that the claimed process did not transform any article to a different state of thing. It noted "[the p]urported transformations or manipulations [of] abstractions cannot meet the test because they are not physical objects or substances, and they are not representative of physical objects or substances."[41] Similarly, the Device Profile Generating Claims do not transform

[39] *Benson*, 409 U.S. at 70 (noting that "[t]ransformation and reduction of an article to a 'different state or thing' is the clue to the patentability of a process claim that does not include particular machines").

[40] *Grames*, 888 F.2d at 840.

[41] *Bilski I*, 545 F.3d at 964.

any article to a different state or thing. The steps of generating first data and second data involve only the use of gathered data and mathematical relationships. The generated first data and second data are still nothing but data. There is no article that has been transformed into a different state or thing.

The method claims that the Federal Circuit held invalid in *Bancorp* under §101 are similar to the Device Profile Generating Claims.[42] The Federal Circuit in *Bancorp* held that calculating various data using a well-known formula is not patent eligible under §101. The court noted that "the claims do not effect a transformation, as they 'do not transform the raw data into anything other than more data and are not representations of any physically existing objects.'"[43] As in *Bancorp*, the Device Profile Generating Claims are invalid because they do not transform the raw data into anything other than more data, and do not represent and are not restricted to any physically existing object.

In *CyberSource*, the Federal Circuit affirmed the district court's holding that a claim directed to a method that organizes data such that additional tests may be performed is invalid under §101. The court noted that the claim failed the transformation test because "[t]he mere manipulation or reorganization of data… does not satisfy the transformation prong."[44] Similar to the claims in *CyberSource*, The Device Profile Generating Claims are invalid because they merely recite assembly of data based on manipulation of pre-existing data and mathematical relationships.

b. The "Device Profile Generating Claims" are invalid because they are directed to an unpatentable abstract idea.

As with the Device Profile Claims analyzed in Section III.B.2.b., *supra*, the

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[42] *Bancorp*, 687 F.3d at 1273.

[43] *Id*.

[44] *CyberSource*, 654 F.3d at 1375.

Device Profile Generating Claims also are not patent eligible because they are directed to an abstract idea.

In *Benson*, the Supreme Court held claims directed to a method of programming a general-purpose computer to convert binary-coded decimal numbers to pure binary through the use of an algorithm to be unpatentable.[45] The Court noted "the conversion of [binary-coded decimal] numbers to pure binary numbers can be done mentally" and "without a computer."[46] In this case, as in *Benson*, generating the first and second data involves nothing more than manipulating gathered pre-existing data (*i.e.*, measured chromatic stimuli and spatial stimuli) and mathematical relationships (*i.e.*, device response characteristic functions). Also, as in *Benson*, the mathematical procedures described in the Device Profile Generating Claims can be performed without a computer.

In *Flook*,[47] the Supreme Court invalidated a claimed method of updating alarm limits consisting of three steps: 1) an initial step that merely measures the present value of the process variable (*e.g.*, temperature); 2) an intermediate step that uses a mathematical formula to calculate an updated alarm-limit value; and 3) a final step in which the actual alarm limit is adjusted to the updated value.[48] The Court noted that "the only novel feature of the method is a mathematical formula."[49] The Court further stated that "if a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory."[50] As in *Flook*, the only asserted novel feature of the Device Profile Generating Claims is the recitation of a

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[45] *Benson*, 409 U.S. at 65.
[46] *Id*. at 67.
[47] *Parker v. Flook*, 437 U.S. 584 (1978).
[48] *Id*. at 585-86.
[49] *Id*. at 585.
[50] *Id*. at 595 (citing *In re Richman*, 563 F.2d at 1030).

method of generating data using pre-existing data and mathematical relationships.

In *Grams*, the Federal Circuit similarly invalidated claims directed to methods of diagnosing an abnormal condition in an individual. The claims there involved a first step of obtaining data from clinical laboratory tests and subsequent steps of analyzing data using a mathematical algorithm.[51] The Court noted "an algorithm, or mathematical formula…like a law of nature…cannot be the subject of a patent," and that data-gathering steps cannot make an otherwise non-statutory claim statutory.[52] The Court also noted that "from the specification to the claim, it is clear…that applicants are, in essence, claiming the mathematical algorithm, which they cannot do under [*Benson*]."[53]

The Device Profile Generating Claims are even more abstract than the claims rejected in *Grams*. As in *Grams*, the claims of the '415 patent focus solely on the assembly of the first and second data based on pre-existing data and mathematical relationships, specifically, the measured chromatic and spatial stimuli and device characteristic functions (Modulation Transfer Function or Weiner Noise Spectrum).[54] Similar to the claims rejected in *Grams*, the Device Profile Generating Claims require manipulating gathered data. As in *Grams*, this Court should hold the Device Profile Generating Claims invalid under §101 as being drawn to a non-statutory mathematical algorithm.

In *Warmerdam*, the Federal Circuit held that claims directed a method for generating a data structure are not patent eligible under §101.[55] The claimed

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[51] *Grams*, 888 F.2d at 837.

[52] *Id*. at 838, 840.

[53] *Id*. at 840 ("The specification does not bulge with disclosure on [laboratory] tests. To the contrary, it focuses on the algorithm itself, although it briefly refers to, without describing, the clinical tests that provide data.").

[54] *See* the '415 patent, 3:12 – 5:23, claims 10-17.

[55] *Warmerdam*, 33 F.3d at 1360.

method in *Warmerdam* comprises two steps: 1) locating the media axis of the object; and 2) creating a hierarchy of bubbles on the media axis. *Id*. at 1357. The Court held the claims to be directed to abstract ideas. It noted "the dispositive issue for assessing compliance with §101… is whether the claim is for a process that goes beyond simply manipulating 'abstract ideas' or 'natural phenomena.'" *Warmerdam* at 1360. The Court noted that the steps of "locating" a media axis and "creating" a bubble hierarchy describe nothing more than the manipulation of basic mathematical constructs, the paradigmatic "abstract idea." *Id*. The Court further held that a physical measurement step alone cannot impart patent eligibility to a claim. *Id*. In addition, the Court held that a claim directed to the data structure generated by the method claims was not patent eligible. *Id*. at 1361-62.

The Device Profile Generating Claims, like the *Warmerdam* claims, require manipulation of measured data and mathematical relationships. *See* the '415 patent, claim 10 (emphasis added) ("generating first data… through use of *measured chromatic stimuli* and device response *characteristic functions*" and "generating second data… through use of *spatial stimuli* and device response *characteristic functions*."). As in *Warmerdam*, the steps of "generating first data" and "generating second data" recited in the Device Profile Generating Claims describe nothing more than the manipulation of basic mathematical algorithms. And, like *Warmerdam*, the final step of combining the first and second data into a device profile amounts to nothing more than another way of describing the manipulation of these abstract ideas. Accordingly, this Court should hold the Device Profile Generating Claims invalid for reciting patent ineligible abstract ideas.

4. The Assertions in Digitech's Letter, Even if True, Do Not Bring the "Device Profile Claims" Within §101.

a. Digitech's claims would still be invalid under §101 even if they included a tag.

Digitech's Letter attempts to avoid invalidity by asserting that the data of the

'415 patent claims is "tagged" or part of a "tangible data structure." But that assertion is unsupported by the claim language or any fair reading of the claims. As Digitech's Letter concedes, a §101 analysis must focus on the language of the claims. The asserted '415 patent claims do not limit the data to include a "tag" or describe any "tangible data structure." Even if they did, however, or if the claims were somehow deemed to be so limited, a tag is merely another piece of data. It does not provide the type of concrete physical structure required to bring a claim within §101.

Indeed, the cases cited by Digitech's Letter support a finding that claims including a tag are invalid.[56] Although the *Microsoft* decision cited by Digitech does not address §101,[57] the claims analyzed in *Microsoft* support Defendants' position.[58] In *Microsoft*, the dispute was whether Microsoft, whose software was only a component of the patented computer, infringed the patent under §271(f) when it shipped software from inside the U.S. to companies abroad to be combined with computers outside the U.S. *Microsoft* contains no §101 analysis. The *Microsoft* claims recited a physical tangible "computer" that could "digitally encode and compress recorded speech." The '415 patent claims do not recite any physical tangible object such as a computer.

The *CNET* decision cited by Digitech also does not address §101 and the claims at issue in that case also support Defendants' position.[59] *CNET*, like *Microsoft*, concerned the extra territorial scope of the U.S. patent laws under §271. The only mention of §101 in *CNET* is to distinguish its requirements from those of §271 ("sections 101 and 271(g) are not coextensive in their scope"). The language

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[56] See cases cited in Digitech's Letter starting at the bottom of page 3 through the first full paragraph on page 4.

[57] The court in *Microsoft* did not conduct any §101 analysis.

[58] *Microsoft Corp. v. AT & T Corp.*, 550 U.S. 437 (2007).

[59] *CNET Networks, Inc. v. Etilize, Inc.*, 528 F.Supp.2d 985, 994 (N.D. Ca1. 2007)

of §271(g) is directed to a "product." *CNET* held that §271(g) was satisfied because the patent claims were "directed toward *creation* of a *product* catalog s*tored on a computer readable media*…." *Id*. at 994. (second emphasis added.) Unlike the '415 patent claims, the CNET patent claims specifically recited these physical components. The '415 patent claims do not recite any physical tangible object such as a computer readable media.

b. The cases cited by Digitech do not support a holding that a "device profile" is a machine or manufacture.

The *Lowrey* decision cited by Digitech does not address §101 and supports Defendants' position.[60] Lowrey appealed the rejection of his patent claims by the BPAI under §§102 and 103. Since the BPAI had confirmed the patentability of Lowry's claims under §101, there was no §101 issue on appeal to the Federal Circuit. Lowrey's patent claims satisfy §101 because the claims recite a memory, a physical tangible object: "Claim 1. A memory for storing data for access by an application program…."[61] And, the Federal Circuit described Lowry's patent as "claim(ing) a memory containing a stored data structure."[62]

In addition to those physical components, the *Lowrey* claims contained a 263 word detailed description of a sophisticated data structure. Digitech's incorrect assertion that its claims should be interpreted to include a "tag" would still not make that "tag" a "tangible data structure" at all similar to the complex data structure claimed in *Lowrey* and ignores the physical memory component explicitly included in Lowrey's claims. Contrary to Digitech's assertion, *Lowrey* did not hold that "device profiles of the claimed invention qualify as both manufactures and machines"[63] or that data structures alone were patentable.

[60] *In re Lowry*, 32 F.3d 1579 (Fed. Cir. 1994).
[61] *Id*. at 1581.
[62] *Id*. at 1581.
[63] Digitech's Letter at page 5, second full paragraph.

The *In re Nuijten* decision cited by Digitech also supports Defendants' position.[64] As noted above in Section III.B.2.a., *In re Nuijten* held patent claims invalid under §101. The '415 patent claims, like the claims in *In re Nuijten* , are invalid under §101 because they are not limited to any "physical medium" and have no "physical limitations."[65] Indeed, the *In re Nuijten* claims are directed to encoding supplemental data on to a signal with a specific data structure.[66] Even accepting Digitech's assertion that a data tag can be read into the '415 patent claims, and its assertion that a tag constitutes some modicum of data structure, the '415 patent claims are still invalid under *In re Nuijten* because they do not have any "physical medium" or any "physical limitations."

Finally, the *Research Corp*. case cited by Digitech provides further support for Defendants' position.[67] The claims in *Research Corp.* are substantially different from the '415 patent claims, because they contained limitations to tangible concrete items such as "high contrast film," "a film printer," "a memory," and "printer and display devices."[68] The '415 patent claims do not recite any tangible structure. Even if it were recited in the '415 patent claims, a tag is just data in a data file. A tag is not analogous to the physical tangible "film" in *Research Corp. Research Corp.* does not support Digitech's assertion that "manipulation of specific data structures" is patent eligible or that Digitech's claims manipulate data structures.

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[64] *In re Nuijten*, 500 F.3d 1346, 1355-56 (Fed Cir. 2007).

[65] *Id*. at 1353.

[66] *Id*. "The only limitations…address the signal's informational content. Specifically, the signal must encode some supplemental data, it must have been encoded according to a 'given encoding process,' and a sample, or single data point, located before the location of the supplemental data must be different from the original."

[67] *Research Corp. Techs., Inc. v. Microsoft Corp.*, 627 F.3d 859 (Fed. Cir. 2010).

[68] *Id*. at 869.

c. Digitech's vague assertions regarding the location of the device profile in the accused products confirm the abstract nature of the asserted claims.

The device profile of the '415 patent consists of data. Confronted with that reality, and in an effort to avoid invalidity, Digitech's Letter makes assertions about where the device profile allegedly can be found in the Defendant's accused products. For example, Digitech asserts that the data of the device profile "comprises software or firmware, running on hardware within a digital image processing system…."[69] Digitech's hardware assertion is completely unlimited—it could be the lens, the processor, the memory, a circuit, or the accused camera or printer itself.[70] Digitech's Letter also asserts that the device profile could be "appended to a digital image" that is sent from the camera or printer. That assertion puts no limit whatsoever on where the data of the device profile can be found—it could be within the numerous software programs contained in the device, some unidentified firmware, any hardware component of the accused device, the accused device itself, or even part of an image file sent from the camera or printer.

It is precisely this type of overbroad claiming that provides the foundation for the Supreme Court's rejection of patents on abstract ideas. And, limiting the data of the device profile to the field of use of digital imaging cannot save the claim from a finding of invalidity for patenting an abstract idea. "[T]he prohibition against patenting abstract ideas 'cannot be circumvented by attempting to limit the use of the formula to a particular technological environment' or adding 'insignificant pos solution activity.'"[71]

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[69] See Digitech's Letter at page 4, first full paragraph.

[70] Indeed, Digitech's infringement contentions actually allege that the "Accused Instrumentalities comprise a device profile…." Exhibit D.

[71] *Bilski II*, 130 S.Ct. at 3230, citing *Diehr*, 450 U.S., at 215.

5. *CLS Bank v. Alice*[72] Supports Invalidating All Asserted Claims Under §101.

In *CLS Bank v. Alice*, an *en banc* panel of the Federal Circuit upheld the trial court's holding that all asserted claims of Alice's four patents were invalid as merely claiming an abstract concept ineligible for patent protection under §101. Although a divided Federal Circuit issued six opinions with no opinion gaining enough votes for a majority, "seven of the ten members, a majority, of [the] en banc court…agreed that the method and computer-readable medium claims…fail to recite patent-eligible subject matter."[73]

Alice's patents "claim computerized methods, computer-readable media, and systems that are useful for conducting financial transactions using a third party to settle obligations."[74] All of the claims "require[d] a computer including at least 'a processor and memory.'"[75]

Because all of Alice's patent claims contained a physical tangible computer, a processor and a memory, they satisfied one of the threshold categories of §101. "Computers are 'machines.' Machines are expressly eligible subject matter under Section 101."[76] Because one of the threshold categories of §101 was thereby satisfied, the Federal Circuit then considered the three specific exceptions ("laws of nature," "physical phenomena," and "abstract ideas."). The various opinions in *CLS* focused on when patent claims directed to a general purpose computer and specialized software are patent eligible, as opposed to merely abstract ideas that are patent ineligible.

CLS supports invalidating all asserted claims of the '415 patent under §101.

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[72] *CLS Bank Int'l v. Alice Corp*., 106 U.S.P.Q.2d 1696 (Fed. Cir. 2013) (en banc).
[73] *Id*. at 1697, fn.1.
[74] *Id*. at 1705.
[75] *Id*. at 1699.
[76] *Id*. at 1721.

First, although *CLS* has no precedential majority opinion, the analytical approach followed by the various opinions is the same approach followed by these moving papers. The first analytical step is to determine if the claims satisfy one of the four threshold categories of §101. If the Court determines that Digitech's patent claims do not satisfy one of those categories then the claims are invalid under §101. Abstractness is only addressed as a second analytical step if the Court determines that Digitech's claims fall within one of the four categories of §101.[77]

Second, Digitech's Letter, in an attempt to save the claims from §101 invalidity, asserts that the claims, without actually reciting "software or firmware running on hardware," somehow include those elements. The claims in *CLS* included substantial hardware and firmware components (computer, processor and memory) in addition to very specific software disclosed in the claim elements and were still found to be invalid under §101. Thus, although the Defendants strongly disagree that Digitech's claims include any of these extra elements, their inclusion would not save Digitech's claims from invalidity under §101 in any event.

Third, the claims in *CLS Bank* included very specific and detailed claims related to the software. Digitech makes only a bare assertion that its claims cover software, while the claims themselves are completely devoid of any software steps, manipulations, or results generated by the software.

Finally, the Court in *CLS* was divided because analyzing claims combining general purpose computers and software under §101 is difficult. Because the Digitech claims do not involve a general purpose computer combined with software, the analytical difficulties faced by the Federal Circuit in *CLS* do not impact the straightforward analysis of the '415 patent claims under §101. The

[77] Digitech's Letter improperly reverses this analytical order by considering abstractness first (see page 2, second full paragraph) and the enumerated §101 categories second (see page 5, second full paragraph).

result of *CLS* is that the Federal Circuit is affirming decisions of invalidity under §101.

IV. CONCLUSION

For the reasons set forth herein, the Court should grant Defendants' motion for summary judgment and hold that the asserted claims are invalid because they are directed to non-statutory subject matter under 35 U.S.C. §101.

Dated: July 3, 2013 Orrick, Herrington & Sutcliffe LLP

By: */s/ CHRISTOPHER P. BRODERICK*
CHRISTOPHER P. BRODERICK

Attorneys for Defendants

FUJIFILM Corporation, Sigma Corporation and Sigma Corporation of America, Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., and Ricoh Americas Corp., Konica Minolta Business Solutions, U.S.A., Inc.

CHRISTOPHER P. BRODERICK
cbroderick@orrick.com
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: 213-629-2020
Facsimile: 213-612-2499

Attorneys for Defendants

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. ELECTRONICS FOR IMAGING, INC., Defendant.	CASE NO. SACV 12-01324-ODW (MRWx) **STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. FUJIFILM CORPORATION, Defendant.	CASE NO. SACV 12-01679-ODW (MRWx) **STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. SIGMA CORPORATION and SIGMA CORPORATION OF AMERICA, Defendants.	CASE NO. SACV 12-01681-ODW (MRWx) **STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. PENTAX RICOH IMAGING COMPANY, LTD., PENTAX RICOH IMAGING AMERICAS CORP., RICOH COMPANY, LTD., AND RICOH AMERICAS CORP., Defendants.	CASE NO. SACV 12-01689-ODW (MRWx) **STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street
DIGITECH IMAGE TECHNOLOGIES, LLC, Plaintiff, v. KONICA MINOLTA BUSINESS SOLUTIONS, U.S.A., INC., Defendants.	CASE NO. SACV 12-01694-ODW (MRWx) **STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSIONS OF LAW IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101** Judge: Hon. Otis D. Wright, II Hearing Date: July 29, 2013 Hearing Time: 1:30 p.m. Location: Courtroom 11, Spring Street

Pursuant to Federal Rule of Civil Procedure 56 and Local Rule 56-1, Defendants FUJIFILM Corporation, Sigma Corporation, Sigma Corporation of America, Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., Ricoh Americas Corp., and Konica Minolta Business Solutions, U.S.A., Inc., (collectively "Defendants"), submit the following STATEMENT OF UNCONTROVERTED FACTS AND CONCLUSION OF LAW IN SUPPORT OF DEFENDANTS' MOTION OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101.

Dated: July 3, 2013

Orrick, Herrington & Sutcliffe LLP

By: */s/ CHRISTOPHER P. BRODERICK*
CHRISTOPHER P. BRODERICK

Attorney for Defendants

FUJIFILM Corporation, Sigma Corporation, Sigma Corporation of America, Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., Ricoh Americas Corp. and Konica Minolta Business Solutions, U.S.A., Inc.

UNCONTROVERTED FACTS

1. UNCONTROVERTED FACTS REGARDING INVALIDITY UNDER 35 U.S.C. §101

NO.	UNCONTROVERTED FACT	SUPPORTING EVIDENCE
1.	Digitech Image Technologies LLC ("Digitech") asserted claims 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, 15, 26, 27, 28, 29, 30 and 31 of U.S. Patent Number 6,128,415 (" the '415 patent") against the Defendants. Three of those asserted claims, claims 1, 10 and 26, are independent claims.	Yen Decl.[1], ¶¶ 7, 8.
2.	Claim 1 of the '415 patent states: "1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising: first data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial	The '415 patent, claim 1. Yen Decl., ¶3, Exhibit A, page 7.

[1] Yen Decl. refers to the concurrently filed concurrently filed DECLARATION OF ANDREW Y. YEN IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF U.S. PATENT NO. 6,128,415 UNDER 35 U.S.C. § 101.

	information content of the image in said device independent color space.”	
3.	Claim 26 of the ‘415 patent states: “26. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.”	The ‘415 patent, claim 26. Yen Decl., ¶3, Exhibit A, page 8.
4.	Claim 10 of the ‘415 patent states: “10. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising: generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli	The ‘415 patent, claim 10. Yen Decl., ¶3, Exhibit A, page 7.

	and device response characteristic functions; generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and combining said first and second data into the device profile."	
5.	The '415 patent states: "The device profile is generated by use of both the measured chromatic response and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device."	The '415 patent at 2:17-21, Yen Decl., ¶3, Exhibit A, page 5.
6.	The '415 patent states: "data is represented by a first characteristic function describing added noise characteristic" and "a second characteristic function describing image signal transform characteristics."	The '415 patent, claims 2, 11 and 27, Yen Decl., ¶3, Exhibit A, pages 7 and 8.
7.	The '415 patent states: "added noise characteristics are represented by a Wiener Noise	The '415 patent at 3:14-21, claims 3, 12 and 28, Yen Decl., ¶3, Exhibit A, pages 6, 7 and 8.

	Spectrum"; and "image signal transform characteristics are represented by a Modulation Transfer Function."	
8.	The '415 patent states: "For non-linear image transforms a set of signal level dependent MTFs could, in principle, be generated to represent the characteristic functions describing the signal transform in the imaging device. In practice a single characteristic function can be generated from an ensemble average of MTFs or a small signal approximation. In general all of these characteristic functions are two-dimensional functions which are represented as M(u,v)."	The '415 patent at 4:34-41, Yen Decl., ¶3, Exhibit A, page 6.
9.	The '415 patent states: "Recently, device independent paradigms for the characterization of color information in an image processing system have been developed and are being implemented: Color Sync, developed by Apple Computer and KCMS, developed by Eastman Kodak Co., are examples of systems or components supporting a device independent color paradigm.	The '415 patent at 1:55-2:1, Yen Decl., ¶3, Exhibit A, page 5.

	This paradigm is based upon a characterization of the image pixel data (digits) in a device independent color space—e.g. CIE L*a*b* or CIE XYZ, and the use of a Color Management System. The characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device."	
10.	The '415 patent states: "For non-stationary image transforms the image signal transform characteristic function can, in principle, be represented by a multi-dimensional function, M(x,y,u,v), generated from a local fourier analysis of the point spread function located at the position (x,y). In practice the characteristic function can be approximated by an ensemble average of the position dependent multi-dimensional function M(x,y,u,v). $M(u,v)=<M(x,y,u,v)>_{xy}$ (7) where the operation $<M(x,y,u,v)>_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y."	The '415 patent at 4:42-54, Yen Decl., ¶3, Exhibit A, page 6.
11.	The Applicants of the '415 patent told the USPTO:	The '415 Prosecution History, 2/9/1999 Amendment, page 2,

	"It is Applicants belief that Applicant is the first to provide a device profile comprising data for describing spatial information of a device in the profile in device independent space. It is recognized that color and space information for device dependent space has been utilized, but not spatial information for device independent color space."	Yen Decl., ¶4, Exhibit B, page 98, emphasis in original.
12.	The Applicants of the '415 patent told the USPTO: "Thus, one of the distinguishing features of the present invention (compared to ST2) is that the present invention actually provides the data required for the operation."	The '415 Prosecution History, 7/19/1999 Amendment, page 7, Yen Decl., ¶4, Exhibit B, page 118.
13.	The Applicants of the '415 patent told the USPTO: "In contrast, the present invention provides the actual data which the spatial algorithm requires for processing."	The '415 Prosecution History, 7/19/1999 Amendment, page 6, Yen Decl., ¶4, Exhibit B, page 117.
14.	The Applicants of the '415 patent told the USPTO: "On the other hand with regards to the present invention, to enable optimization, the Applicants developed something referred to as a 'profile' which contains an abstract description of the spatial response properties	The '415 Prosecution History, 7/19/1999 Amendment, page 9, Yen Decl., ¶4, Exhibit B, page 120.

	of any device in question…”	
15.	The Applicants of the ‘415 patent told the USPTO: “Rather, as one skilled in the art would appreciate, the measurement of micro-image properties such as MTF and the Weiner spectrum of noise require some form of a microdensitometer for analysis… of the developed image”	The ‘415 Prosecution History, 12/30/1999 Notice of Appeal, page 10, Yen Decl., ¶4, Exhibit B, page 148.
16.	The Applicants of the ‘415 patent told the USPTO: “Whereas the Applicants’ present invention addresses a system and method for furnishing the data structures required for such a Spatial Management system, i.e., to apply a device independent paradigm to spatial processing in a digital image processing system…”	The ‘415 Prosecution History, 12/30/1999 Notice of Appeal, page 6, Yen Decl., ¶4, Exhibit B, page 144.
17.	The Applicants of the ‘415 patent told the USPTO: “Transformations applied to the color space coordinate—e.g., transforming the device dependent video {rgb}triplet to a device independent tristimulus triplet {XYZ}…”	The ‘415 Prosecution History, 12/30/1999 Notice of Appeal, page 5, Yen Decl., ¶4, Exhibit B, page 143.
18.	The Applicants of the ‘415 patent told the USPTO:	The ‘415 Prosecution History, 12/30/1999 Notice of Appeal, pages 9-10, Yen Decl., ¶4,

	"Any ordinary artesian would know that the XYZ space is a color space taught by Schreiber[10] (Schreiber, p. 177). [10] Schreiber, *W.F., Fundamental of Electronic Imaging Systems*, 2nd ed., Springer-Verlag, Germany (1991)."	Exhibit B, pages 147 and 148.
19.	Schreiber, W.F., *Fundamental of Electronic Imaging Systems*, 2nd ed., Springer-Verlag, Germany (1991), at page 177 states: "However, the transformation can also be done theoretically by the method of Wintringham, showing that if *R, G, B* are tristimulus values with respect to the previously used spectral primaries, and if *X, Y, Z* are tristimulus value with respect to the CIE primaries, then $X = 2.769R + 1.752G + 1.130B$ $Y = 1.000R + 4.591G + 0.060B$ $Z= 0.000R + 0.057G + 5.593B$"	The '415 Prosecution History, 12/30/1999 Notice of Appeal, pages 9-10, Yen Decl., ¶4, Exhibit B, page 168.
20.	Digitech's infringement contentions allege that "the Accused Instrumentality comprises a device profile…"	Yen Decl., ¶6, Exhibit D, pages 324, 325, 327 and 329.

CONCLUSIONS OF LAW

1. Claims 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, 15, 26, 27, 28, 29, 30 and 31 of U.S. Patent Number 6,128,415 are invalid under 35 U.S.C. 101.

CHRISTOPHER P. BRODERICK
cbroderick@orrick.com
ORRICK, HERRINGTON & SUTCLIFFE LLP
777 South Figueroa Street, Suite 3200
Los Angeles, California 90017
Telephone: 213-629-2020
Facsimile: 213-612-2499

Attorneys for Defendants

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1. I am an attorney with the law firm of Orrick, Herrington & Sutcliffe LLP, counsel for FUJIFILM Corporation ("FUJIFILM"), Sigma Corporation, Sigma Corporation of America ("Sigma"), Pentax Ricoh Imaging Company, Ltd., Pentax Ricoh Imaging Americas Corp., Ricoh Company, Ltd., Ricoh Americas Corp. ("Ricoh"), and Konica Minolta Business Solutions, U.S.A., Inc. ("KMBUS"), (collectively "Defendants") in this matter. The following is based upon my personal knowledge, and if called as a witness I could and would testify competently thereto.

2. The parties met and conferred in good faith on May 23, 2013 regarding the filing of this summary judgment motion. Plaintiff's counsel stated that Digitech opposed Defendants' summary judgment motion.

3. Attached hereto as Exhibit A is a true and correct copy of U.S. Patent No. 6,128,415 (the "'415 patent").

4. Attached hereto as Exhibit B is a true and correct copy of the prosecution history of the '415 patent produced to the Defendants by Digitech Image Technologies, LLC. ("Digitech") The document received by the Defendants contained yellow highlighting. The Defendants did not highlight any portion of this document.

5. Attached hereto as Exhibit C is a list of 15 recent cases where the Board of Patent Appeals and Interferences (BPAI) issued §101 rejections missed by patent examiners.

6. Attached hereto as Exhibit D are excerpts from representative Digitech infringement contentions against FUJIFILM (page 324), Sigma (page 325), Ricoh (pages 326-327) and KMBUS (pages 328-329). The green highlighting was added by the Defendants. All other annotations were made by Digitech.

7. I have reviewed all of the infringement contentions that Digitech served on the Defendants.

8. Digitech accused the Defendants of infringing claims 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, 15, 26, 27, 28, 29, 30 and 31 of the '415 patent.

I declare on penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed this 3rd day of July, 2013 in Los Angeles, California.

Andrew Y. Yen

Exhibit A

US006128415A

United States Patent [19]

Hultgren, III et al.

[11] **Patent Number: 6,128,415**

[45] **Date of Patent: *Oct. 3, 2000**

[54] **DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM**

[75] Inventors: **Bror O. Hultgren, III**, Ipswich; **F. Richard Cottrell**, Easton; **Jay E. Thornton**, Watertown, all of Mass.

[73] Assignee: **Polaroid Corporation**, Cambridge, Mass.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/709,487**

[22] Filed: **Sep. 6, 1996**

[51] **Int. Cl.**^{7} **G06K 9/00**; G06K 9/36; G03F 3/08; G03F 3/10

[52] **U.S. Cl.** **382/276**; 382/162; 382/167; 382/266; 345/431; 358/518; 358/527

[58] **Field of Search** 382/167, 276, 382/266, 239, 162; 358/518, 527, 520; 345/418, 431

[56] **References Cited**

U.S. PATENT DOCUMENTS

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5,257,097	10/1993	Pineau et al.	358/527
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Murch "New Paradigms for Visualization," IEEE. pp. 550–551, 1990.

ICC Profile Format Specification, Version 3.10b, Oct. 21, 1995.

Primary Examiner—Andrew J. Johns
Assistant Examiner—Daniel G. Mariam
Attorney, Agent, or Firm—Robert J. Decker

[57] **ABSTRACT**

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

33 Claims, 3 Drawing Sheets

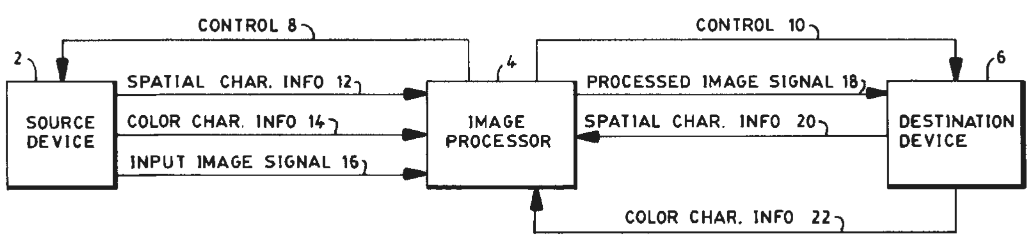

EXHIBIT A
PAGE 1

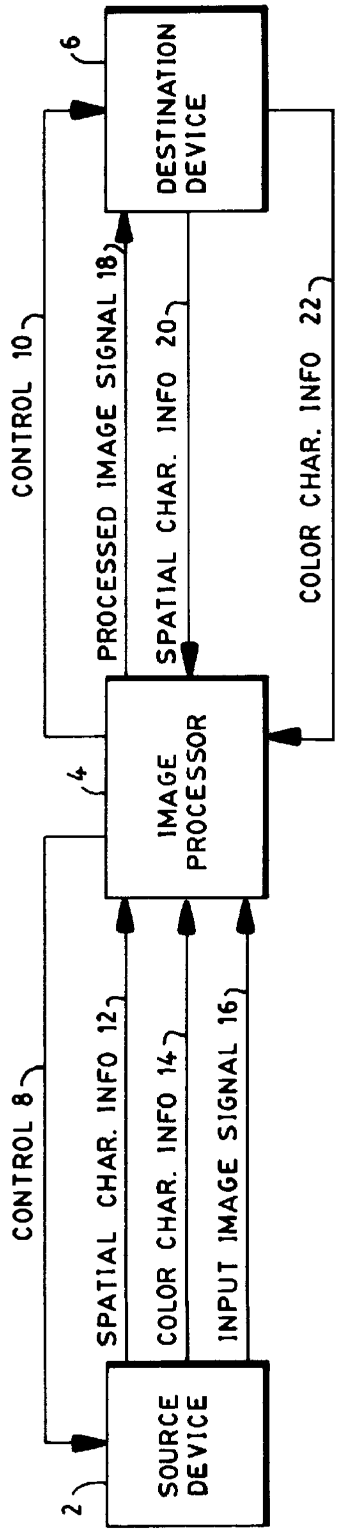
DESTINATION DEVICE
6
CONTROL 10
PROCESSED IMAGE SIGNAL 18
SPATIAL CHAR. INFO 20
COLOR CHAR. INFO 22
IMAGE PROCESSOR
4
CONTROL 8
SPATIAL CHAR. INFO 12
COLOR CHAR. INFO 14
INPUT IMAGE SIGNAL 16
SOURCE DEVICE
2

FIG. 1

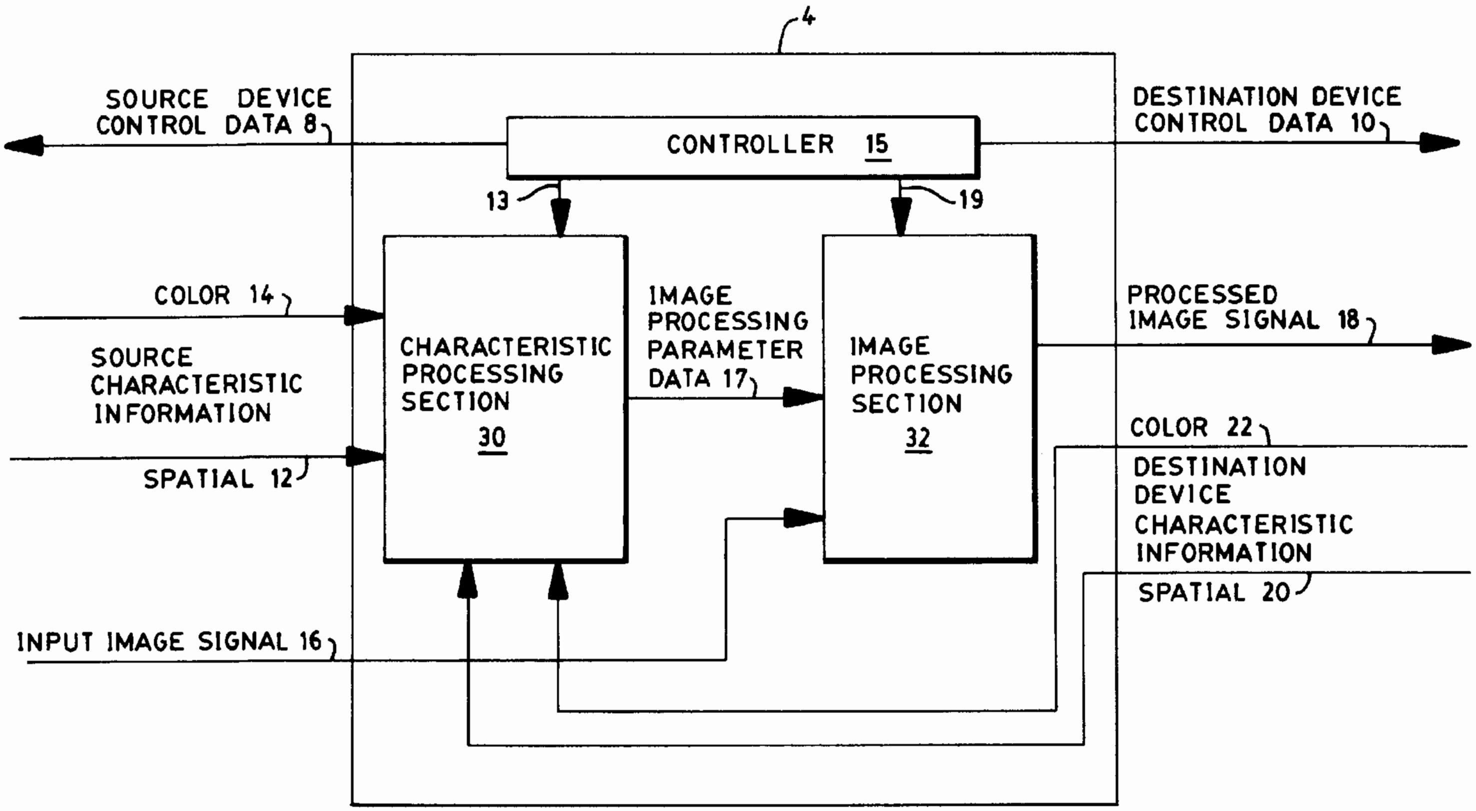
4
SOURCE DEVICE CONTROL DATA 8
CONTROLLER 15
DESTINATION DEVICE CONTROL DATA 10
13
19
COLOR 14
SOURCE CHARACTERISTIC INFORMATION
SPATIAL 12
CHARACTERISTIC PROCESSING SECTION 30
IMAGE PROCESSING PARAMETER DATA 17
IMAGE PROCESSING SECTION 32
PROCESSED IMAGE SIGNAL 18
COLOR 22
DESTINATION DEVICE CHARACTERISTIC INFORMATION
SPATIAL 20
INPUT IMAGE SIGNAL 16

FIG. 2

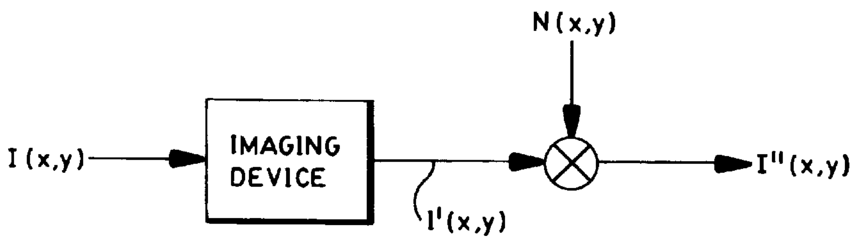

FIG. 3

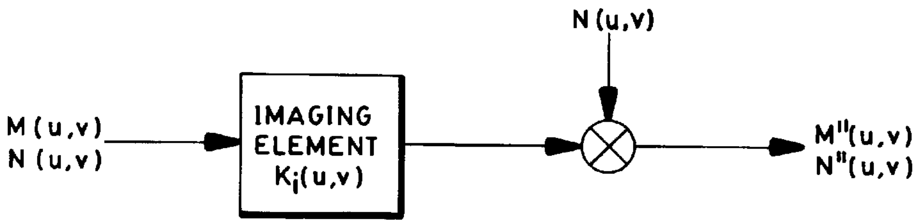

FIG. 4

EXHIBIT A
PAGE 4

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed generally towards digital image processing and more specifically towards generation and use of an improved device profile for describing both spatial and color properties of a device within an image processing system, so that a processed image can be more accurately captured, transformed or rendered.

2. Description of the Prior Art

Digital image processing involves electronically capturing an image of a scene, altering the captured image in some desired fashion and passing the altered image to an output device. An upstream element of a digital image processing system can be thought of as a source device, whereas a downstream element can be thought of as a destination device. For instance, a simple image processing system could include an acquisition device such as a digital camera, camcorder, scanner, CCD, etc., a color processor for processing the colors of the image, and an output device, such as a printer, monitor, computer memory, etc. When considering a communication between the acquisition device and the color processor, the acquisition device is deemed as the source device whereas the color processor is deemed as the destination device. When considering a communication between the color processor and the output device, the color processor is deemed as the source device whereas the output device is deemed as the destination device.

All imaging devices, either image acquisition or image display, will impose distortions of the color and spatial components of the image data.

Historically, industry has chosen to correct these distortions with device dependent solutions. It is common practice in the industry that an integral part of the design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices to ameliorate these distortions. For example, electronic peaking filters are often employed in video capture devices to correct for the blurring effects of anti-aliasing filters and amplifier frequency response. Electronic imaging devices are commonly designed to function with specific upstream (in the case of display devices) or downstream (in the case of image sources) devices to provide quality images. For example, image capture devices commonly transform the image digits to compensate ('gamma corrected') for the CRT volts-luminance characteristics of CRT displays. Such design considerations provide a device dependent model for that specific implementation of an image processing system, but do not provide the same degree of image quality when substituting an alternative device.

Recently, device independent paradigms for the characterization of color information in an image processing system have been developed and are being implemented: Color Sync, developed by Apple Computer and KCMS, developed by Eastman Kodak Co., are examples of systems or components supporting a device independent color paradigm. This paradigm is based upon a characterization of the image pixel data (digits) in a device independent color space—e.g. CIE L*a*b* or CIE XYZ, and the use of a Color Management System. The characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device. However, the spatial characteristics of digital imaging devices are still modified in the context of the device dependent model described above.

In order to improve processing flexibility and versatility, it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system. This paradigm will capture the spatial characterization of the imaging device in a tagged file format, referred to as a device spatial profile.

SUMMARY OF THE INVENTION

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured chromatic response and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned aspects and other features of the invention are described in detail in conjunction with the accompanying drawings in which the same reference numerals are used throughout for denoting corresponding elements and wherein:

FIG. **1** is a block diagram of a basic digital image processing system according to the invention;

FIG. **2** is a detailed block diagram of the image processor of FIG. **1**;

FIG. **3** is a model of characteristic functions sufficient to reconstruct signal and noise power distributions for linear, stationary image systems having additive noise; and

FIG. **4** is a model of the effect of an image processing element upon an image.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A simplified version of a digital image processing system is shown in the block diagram of FIG. **1**. The acquisition device **2**, for instance a digital camera, acquires an image which is represented as the input image signal **16**. The image processor **4** receives the input image signal **16**, acquisition device spatial characteristic information **12** and acquisition device color characteristic information **14** in response to a control signal **8**. The image processor **4** also receives output device spatial characteristic information **20** and output device color characteristic information **22** from the output device **6** in response to a control signal **10**. After processing the input image signal **16** in accordance with all the signals received by the processor **4**, the image processor **4** sends the processed image signal **18** to output device **6**, for instance a printer which produces a hardcopy of the processed image.

An image includes both spatial and chromatic information. The spatial content of an image can be described by its signal and noise power distributions. An image's signal or noise power distribution will be transformed by a device but

does not give an unique description of the device because the distributions are image specific and they will be determined by the result of all preceding image transformations. However for one class of imaging devices namely linear, stationary imaging systems with additive noise, characteristic functions sufficient to reconstruct the signal and noise power distributions can be constructed. In practice many systems not conforming to these conditions can be approximated as linear, stationary imaging systems with additive noise having sufficient accuracy to enable the prediction of perceived image quality if not full image reconstruction.

Spatial characteristics of the elements of an image processing system or platform can be represented in at least two forms. In a first form, a characteristic processing section **30** of the image processing platform contains spatial characteristic functions describing added noise and image signal transform characteristics of the source and destination devices. In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, the characteristic processing section **30** contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. patent application Ser. No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation. This patent application is hereby incorporated in its entirety to provide supplemental background information which is non-essential but helpful in appreciating the applications of the present invention.

FIG. **2** is a detailed diagram of the image processor **4** of FIG. **1**. The image processor **4** includes a controller **15**, a characteristic processing section **30** and an image processing section **32**. The characteristic processing section **30** produces image processing data **17** in response to color source characteristic information **14**, spatial source characteristic information **12**, color destination device characteristic information **22**, spatial destination device characteristic information **20**, and a first control signal **13** from the controller **15**. In turn, the image processing section **32** produces a processed image signal **18** in response to the image processing parameter data **17**, an input image signal **16** and a second control signal **19** from the controller **4**. The controller **15** also generates both source device control data **8** and destination device control data **10**.

If I(x,y) represents the intensity distribution over the spatial coordinates (x,y) of the image and I(u,v) represents the corresponding frequency domain representation of the image constructed from the Fourier transform of I(x,y), then the transformation of the image by a linear, stationary imaging element can be represented as shown in FIG. **3**. In the spatial domain the transformation is described by a Linear function S(g(x,y)):

$$I'(x,y)=S(I(x,y)) \quad (1)$$

$$I''(x,y)=S(I(x,y)+N(x,y)) \quad (2)$$

and in the Fourier (spatial frequency) domain by the Fourier Transform S(G(u,u)) of S(g(x,y)):

$$I(u,v)=S(I(u,v)) \quad (3)$$

$$I''(u,v)=S(I(u,v)+N(u,v)) \quad (4)$$

where N(x,y) and its corresponding Fourier Transform N(u,v) represents the additive noise.

For a linear, stationary imaging system, the transfer function S(g(x,y)) is given by

$$S(g(x,y))=s(x,y)\otimes g(x,y) \quad (5)$$

where $\otimes$ signifies convolution. S(G(u,v) is given by:

$$S(G(u,v\ )=S(u,v)*G(u,v) \quad (6)$$

where * signifies point multiplication.

In principle S(u,v) can be computed from the ratio of the output/input signal power distributions. In practice, S(u,v) is determined from fourier analysis of images of step input images via edge gradient analysis, or point or line images via point or line spread analysis. The transfer function is commonly called the Modulation Transfer Function (MTF).

If the input image is an uniform image $I(x,y)=I_0$, Fourier analysis of the output image will yield the Wiener Noise Power Spectrum N(u,v) which is the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

As stated previously, most real systems violate the criteria for being linear and stationary; and while introducing additive noise, that noise is often gray level dependent. This type of noise is referred to as non-linear, non-stationary, gray level dependent additive noise.

If a number of uniform field images, each described by a constant intensity I_y (where Y represents the luminance level) are processed by a device, Fourier analysis of the output images will yield Wiener Noise Power Spectra N_y(u, v). The set of gray level dependent Wiener Noise Power Spectra represents the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

For non-linear image transforms a set of signal level dependent MTFs could, in principle, be generated to represent the characteristic functions describing the signal transform in the imaging device. In practice a single characteristic function can be generated from an ensemble average of MTFs or a small signal approximation. In general all of these characteristic functions are two-dimensional functions which are represented as M(u,v).

For non-stationary image transforms the image signal transform characteristic function can, in principle, be represented by a multi-dimensional function, M(x,y,u,v), generated from a local fourier analysis of the point spread function located at the position (x,y). In practice the characteristic function can be approximated by an ensemble average of the position dependent multi-dimensional function M(x,y,u,v).

$$M(u,v)=\langle M(x,y,u,v)\rangle_{xy} \quad (7)$$

where the operation $\langle M(x,y,u,v)\rangle_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y.

The processing of spatial characteristic functions in the image processing system of the preferred embodiment is model based. For a linear imaging system with additive noise, each image processing element is represented by a transfer function that is a model of the effect of that image processing element upon an image as shown in FIG. **4** and defined by equations (7) and (8) in the frequency domain.

$$M''(u,v)=Ki(u,v)*M(u,v) \quad (8)$$

$$N''(u,v)=Ki^2(u,v)*N(u,v)+Ni(u,v) \quad (9)$$

For non-linear imaging elements, the transfer function may be a more general representation of the characteristic func-

tions presented to the imaging element and evaluated in terms of a model of the imaging element.

Spatial characteristic functions are generated from fourier analysis of selected target images. Characteristic functions (a) may be scalar, one or two dimensional arrays for at least one of the device N channels, (b) are evaluated over the spatial frequency range 0 to the Nyquist frequency in equal frequency intervals, and (c) for source devices may be stated either in a proprietary processing space or in device independent space.

In the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format, as described in the ICC Profile Specification, version 3. 10b dated Oct. 21, 1995. The tagged format should include information as to which class the particular characteristic function belongs, i.e. Modulation Transfer Functions, Wiener Noise Power Spectra, or gray level dependent Wiener noise masks. The tagged format should also include information sufficient to identify both the relevant units of spatial frequency and the dimensionality of the characteristic functions. Propagation of characteristic functions is calculated within the context of the model based image processing system.

It is to be understood that the above described embodiments are merely illustrative of the present invention and represent a limited number of the possible specific embodiments that can provide applications of the principles of the invention. Numerous and varied other arrangements may be readily devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention as claimed.

What is claimed is:

1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.

2. The device profile of claim **1** wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

3. The device profile of claim **2**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

4. The device profile of claim **1**, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

5. The device profile of claim **1**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

6. The device profile of claim **5**, wherein said gray level dependent additive noise is spatially dependent.

7. The device profile of claim **1**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

8. The device profile of claim **7**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

9. The device profile of claim **1** wherein, for said device, the second data is generated through use of spatial stimuli and device response characteristic functions.

10. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;

generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and

combining said first and second data into the device profile.

11. The method of claim **10** wherein, for said device:

said second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

12. The method of claim **11** wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

13. The method of claim **11** wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

14. The method of claim **11**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

15. The method of claim **13**, wherein said gray level dependent additive noise is spatially dependent.

16. The method of claim **11**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

17. The method of claim **16**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

18. A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space through use of chromatic response characteristic functions; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device independent color space through the use of spatial characteristic fimctions describing image spatial transform characteristics in said device independent color space.

19. The system of claim **18**, wherein the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

20. The system of claim **19**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

21. The system of claim **18**, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

22. The system of claim **18**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

23. The system of claim **22**, wherein said gray level dependent additive noise is spatially dependent.

24. The system of claim **18**, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

25. The system of claim **24**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

26. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

27. The device profile of claim **26** wherein, for said device, the data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

28. The device profile of claim **27**, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

29. The device profile of claim **26**, wherein the data is represented by characteristic functions describing a gray level dependent additive noise in said device.

30. The device profile of claim **26**, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

31. The device profile of claim **30**, wherein said gray level dependent additive noise is spatially dependent.

32. The device profile of claim **26**, wherein the data is represented by characteristic functions describing spatially dependent additive noise in said device.

33. The device profile of claim **32**, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

* * * * *

Exhibit B

FILE HISTORY
US 6,128,415

PATENT:	6,128,415
INVENTORS:	Hultgren, III, Bror O. Cottrell, F. Richard Thornton, Jay E.
TITLE:	Device profiles for use in a digital image processing system
APPLICATION NO:	US1996709487A
FILED:	06 SEP 1996
ISSUED:	03 OCT 2000
COMPILED:	30 JAN 2012

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
08/709 487	09/06/96	382	276	~~2776~~ 2721	MARIAM

BROR O. HULTGREN III, IPSWICH, MA; F. RICHARD COTTRELL, EASTON, MA; JAY E. THORNTON, WATERTOWN, MA.

CONTINUING DATA*******************
VERIFIED

dQ none

FOREIGN/PCT APPLICATIONS**********
VERIFIED

dQ none [redacted]

FOREIGN FILING LICENSE GRANTED 10/19/96

	AS FILED	STATE OR COUNTRY	SHEETS DRWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
Foreign priority claimed ☒ yes ☒ no; 35 USC 119 conditions met ☐ yes ☐ no; Verified and Acknowledged; Examiner's Initials	→	MA	3	33	4	$1,070.00	8166(RAS)

~~POLAROID CORPORATION~~
~~PATENT DEPARTMENT~~
~~549 TECHNOLOGY SQUARE~~
~~CAMBRIDGE MA 02139~~

#020349

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

U.S. DEPT. of COMM. Patent and Trademark Office PTO-436L (rev. 7-94)

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6,128,415

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Transaction History

Date	Transaction Description
9/23/1996	Initial Exam Team nn
10/30/1996	Application Captured on Microfilm
11/15/1996	Case Docketed to Examiner in GAU
11/15/1996	Transfer Inquiry
3/24/1997	Information Disclosure Statement (IDS) Filed
3/24/1997	Information Disclosure Statement (IDS) Filed
5/27/1997	Preliminary Amendment
11/3/1997	Case Docketed to Examiner in GAU
12/8/1997	Non-Final Rejection
12/10/1997	Mail Non-Final Rejection
3/11/1998	Response after Non-Final Action
3/12/1998	Date Forwarded to Examiner
5/26/1998	Final Rejection
6/2/1998	Mail Final Rejection (PTOL - 326)
9/2/1998	Continuing Prosecution Application - Continuation (ACPA)
9/2/1998	Mail Express Abandonment (During Examination)
9/2/1998	Express Abandonment (during Examination)
9/10/1998	Date Forwarded to Examiner
10/1/1998	Non-Final Rejection
10/7/1998	Mail Non-Final Rejection
2/8/1999	Response after Non-Final Action
2/8/1999	Request for Extension of Time - Granted
2/10/1999	Date Forwarded to Examiner
4/12/1999	Non-Final Rejection
4/14/1999	Mail Non-Final Rejection
7/19/1999	Response after Non-Final Action
7/27/1999	Date Forwarded to Examiner
9/24/1999	Mail Final Rejection (PTOL - 326)
9/24/1999	Final Rejection
12/30/1999	Amendment/Argument after Notice of Appeal
12/30/1999	Notice of Appeal Filed
1/20/2000	Examiner Interview Summary Record (PTOL - 413)

1/21/2000	Mail Notice of Allowance
1/21/2000	Notice of Allowance Data Verification Completed
2/23/2000	Workflow - File Sent to Contractor
2/28/2000	Issue Fee Payment Verified
2/28/2000	Workflow - Drawings Finished
2/28/2000	Workflow - Drawings Matched with File at Contractor
2/28/2000	Workflow - Drawings Received at Contractor
2/28/2000	UnMatched Papers in Pubs
2/28/2000	Workflow - Drawings Sent to Contractor
3/28/2000	Workflow - Complete WF Records for Drawings
8/20/2000	Application Is Considered Ready for Issue
9/14/2000	Issue Notification Mailed
10/3/2000	Recordation of Patent Grant Mailed
9/24/2009	Applicant Has Filed a Verified Statement of Small Entity Status in Compliance with 37 CFR 1.27

APPROVED FOR LICENSE OCT 0 9 1998 6

INITIALS

08/709487

PATENT APPLICATION

08709487

CONTENTS

Date Entered or Counted			Date Received or Mailed
	1.	Application 3 papers.	
	2.	PRIOR Art	3-24-97
	3.	Pre Amdt A	5-27-97
DW	4.	Rej - 3 Mos	12-10-97
	5.	Amdt B	3/11/98 CM
5-26	6.	FINAL REJ - 3 MOS	6-2-98
	7.	Req for CPA	9-2-98
	8.	Recon.	9-2-98
	9.	REJ (3 month)	10/7/98
	10.	Change of Address Customer #	12-1-98
	11.	Ext of Time 1 mo.	2-8-99
	12.	Req for Recon	2-8-99
4-12	13.	Rej (3 mos)	4-14-99
	14.	Amdt C	7-19-99 CM
9/21	15.	F Rej 3mos	9/24/99
	16.	Notice of Appeal	12-30-99 CM
	17.	Amdt D w/Attach (AE)	12-30-99 CM
	18.	Interview Summary	1-20-00
1-21	19.	Notice Allow	1-21-00
3-28-00	20.	Formal Drawings 3 shts) set 1	2-28-00
	21.		
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[redacted]

SEARCHED

Class	Sub.	Date	Exmr.
382	167	12-1-97	dG
	276		
	266		
	239		
382	162	12-2-97	dG
update all of the above	Searched	5-11-98	dG
update all of the above	searched	9-29-98	dG
358	518	9-30-98	dG
	527		
update all of	Searched the above	4-10-99	dG
358	520		
345	418		
	431		
update searched all of the above		9-17-99	dG
update all of the above	Searched	1-20-00	dG

SEARCH NOTES

	Date	Exmr.
STN	5-6-98	dG
IEEE	9-29-98	dG
APS	4-10-99	dG

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
382	162	1-20-00	dG
	167	INTERFERENCE	
	239	FILES	are
	266	Unavailable	
	276		
358	518		
	520		
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PAGE 14

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POSITION		ID NO.	DATE
CLASSIFIER	#44		10-1-96
EXAMINER		708	101796
TYPIST		amo	10/19
VERIFIER		277	10/25
CORPS CORR.			
SPEC. HAND			
FILE MAINT.			
DRAFTING			

INDEX OF CLAIMS

Claim Final	Claim Original	Data 12/2/97	5/11/98	9/30/98	4/11/99	9/20/99	1/20/00		
1	1	✓	✓	✓	✓	✓	=		
2	2	✓	✓						
3	3	✓	✓						
4	4	✓	✓						
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SYMBOLS

- ✓ .... Rejected
- = ... Allowed
- \- (Through numeral) Canceled
- \+ .... Restricted
- N .... Non-elected
- I .... Interference
- A .... Appeal
- O .... Objected

Claim Final	Claim Original	Data							
	51								
	52								
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	99								
	100								

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PATENT NUMBER

ORIGINAL CLASSIFICATION

CLASS	SUBCLASS
382	276

APPLICATION SERIAL NUMBER

08/709,487

APPLICANT'S NAME (PLEASE PRINT)

HULTGREN, et al.

IF REISSUE, ORIGINAL PATENT NUMBER

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)			
382	162	167	266	
345	431			
358	518	527		

INTERNATIONAL CLASSIFICATION

G	0	6	K		9/00
G	0	6	K		9/36
G	0	3	F		3/08
G	0	3	F		3/10

GROUP ART UNIT 2721

ASSISTANT EXAMINER (PLEASE STAMP OR PRINT FULL NAME) DANIEL G. MARIAM

PRIMARY EXAMINER (PLEASE STAMP OR PRINT FULL NAME) ANDREW W. JOHNS

PTO 270 (REV. 5-91)

ISSUE CLASSIFICATION SLIP

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

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US006128415A

United States Patent [19]

Hultgren, III et al.

[11] **Patent Number: 6,128,415**

[45] **Date of Patent: *Oct. 3, 2000**

[54] **DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM**

[75] Inventors: **Bror O. Hultgren, III**, Ipswich; **F. Richard Cottrell**, Easton; **Jay E. Thornton**, Watertown, all of Mass.

[73] Assignee: **Polaroid Corporation**, Cambridge, Mass.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/709,487**

[22] Filed: **Sep. 6, 1996**

[51] Int. Cl.[7] **G06K 9/00**; G06K 9/36; G03F 3/08; G03F 3/10

[52] U.S. Cl. **382/276**; 382/162; 382/167; 382/266; 345/431; 358/518; 358/527

[58] Field of Search 382/167, 276, 382/266, 239, 162; 358/518, 527, 520; 345/418, 431

[56] **References Cited**

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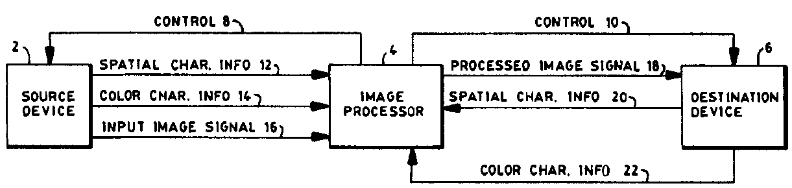
Primary Examiner—Andrew J. Johns
Assistant Examiner—Daniel G. Mariam
Attorney, Agent, or Firm—Robert J. Decker

[57] **ABSTRACT**

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

33 Claims, 3 Drawing Sheets



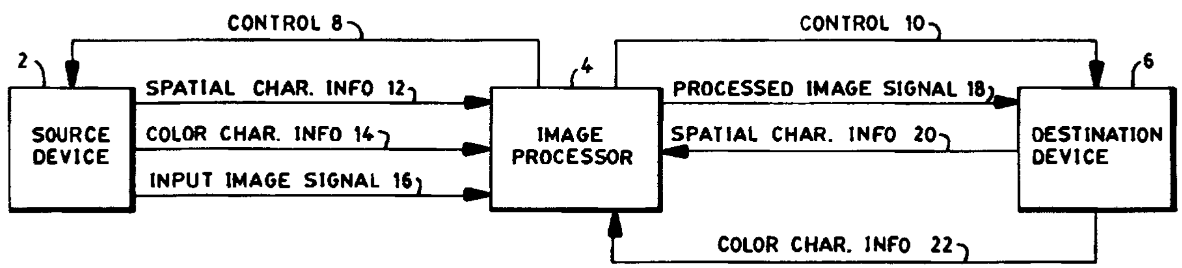
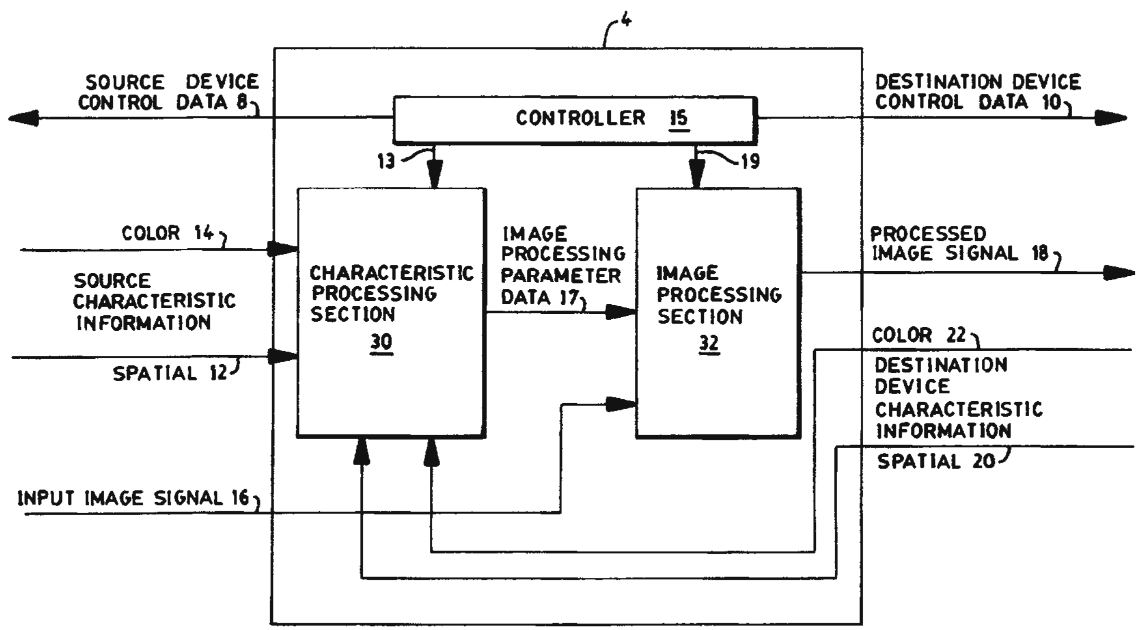

CONTROL 8
CONTROL 10
2
4
6
SOURCE DEVICE
SPATIAL CHAR. INFO 12
COLOR CHAR. INFO 14
INPUT IMAGE SIGNAL 16
IMAGE PROCESSOR
PROCESSED IMAGE SIGNAL 18
SPATIAL CHAR. INFO 20
DESTINATION DEVICE
COLOR CHAR. INFO 22

FIG. 1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SOURCE DEVICE CONTROL DATA 8
CONTROLLER 15
DESTINATION DEVICE CONTROL DATA 10
13
19
COLOR 14
SOURCE CHARACTERISTIC INFORMATION
SPATIAL 12
CHARACTERISTIC PROCESSING SECTION 30
IMAGE PROCESSING PARAMETER DATA 17
IMAGE PROCESSING SECTION 32
PROCESSED IMAGE SIGNAL 18
COLOR 22
DESTINATION DEVICE CHARACTERISTIC INFORMATION
SPATIAL 20
INPUT IMAGE SIGNAL 16

FIG. 2

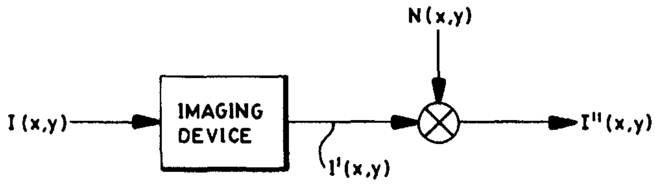
N(x,y)
I(x,y)
IMAGING DEVICE
I'(x,y)
I''(x,y)

FIG. 3

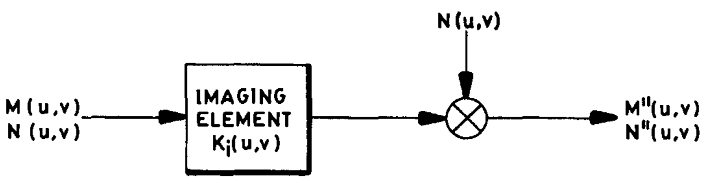
N(u,v)
M(u,v)
N(u,v)
IMAGING ELEMENT
Ki(u,v)
M''(u,v)
N''(u,v)

FIG. 4

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed generally towards digital image processing and more specifically towards generation and use of an improved device profile for describing both spatial and color properties of a device within an image processing system, so that a processed image can be more accurately captured, transformed or rendered.

2. Description of the Prior Art

Digital image processing involves electronically capturing an image of a scene, altering the captured image in some desired fashion and passing the altered image to an output device. An upstream element of a digital image processing system can be thought of as a source device, whereas a downstream element can be thought of as a destination device. For instance, a simple image processing system could include an acquisition device such as a digital camera, camcorder, scanner, CCD, etc., a color processor for processing the colors of the image, and an output device, such as a printer, monitor, computer memory, etc. When considering a communication between the acquisition device and the color processor, the acquisition device is deemed as the source device whereas the color processor is deemed as the destination device. When considering a communication between the color processor and the output device, the color processor is deemed as the source device whereas the output device is deemed as the destination device.

All imaging devices, either image acquisition or image display, will impose distortions of the color and spatial components of the image data.

Historically, industry has chosen to correct these distortions with device dependent solutions. It is common practice in the industry that an integral part of the design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices to ameliorate these distortions. For example, electronic peaking filters are often employed in video capture devices to correct for the blurring effects of anti-aliasing filters and amplifier frequency response. Electronic imaging devices are commonly designed to function with specific upstream (in the case of display devices) or downstream (in the case of image sources) devices to provide quality images. For example, image capture devices commonly transform the image digits to compensate ('gamma corrected') for the CRT volts-luminance characteristics of CRT displays. Such design considerations provide a device dependent model for that specific implementation of an image processing system, but do not provide the same degree of image quality when substituting an alternative device.

Recently, device independent paradigms for the characterization of color information in an image processing system have been developed and are being implemented: Color Sync, developed by Apple Computer and KCMS, developed by Eastman Kodak Co., are examples of systems or components supporting a device independent color paradigm. This paradigm is based upon a characterization of the image pixel data (digits) in a device independent color space—e.g. CIE L*a*b* or CIE XYZ, and the use of a Color Management System. The characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device. However, the spatial characteristics of digital imaging devices are still modified in the context of the device dependent model described above.

In order to improve processing flexibility and versatility, it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system. This paradigm will capture the spatial characterization of the imaging device in a tagged file format, referred to as a device spatial profile.

SUMMARY OF THE INVENTION

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured chromatic response and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned aspects and other features of the invention are described in detail in conjunction with the accompanying drawings in which the same reference numerals are used throughout for denoting corresponding elements and wherein:

FIG. 1 is a block diagram of a basic digital image processing system according to the invention;

FIG. 2 is a detailed block diagram of the image processor of FIG. 1;

FIG. 3 is a model of characteristic functions sufficient to reconstruct signal and noise power distributions for linear, stationary image systems having additive noise; and

FIG. 4 is a model of the effect of an image processing element upon an image.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A simplified version of a digital image processing system is shown in the block diagram of FIG. 1. The acquisition device 2, for instance a digital camera, acquires an image which is represented as the input image signal 16. The image processor 4 receives the input image signal 16, acquisition device spatial characteristic information 12 and acquisition device color characteristic information 14 in response to a control signal 8. The image processor 4 also receives output device spatial characteristic information 20 and output device color characteristic information 22 from the output device 6 in response to a control signal 10. After processing the input image signal 16 in accordance with all the signals received by the processor 4, the image processor 4 sends the processed image signal 18 to output device 6, for instance a printer which produces a hardcopy of the processed image.

An image includes both spatial and chromatic information. The spatial content of an image can be described by its signal and noise power distributions. An image's signal or noise power distribution will be transformed by a device but

does not give an unique description of the device because the distributions are image specific and they will be determined by the result of all preceding image transformations. However for one class of imaging devices namely linear, stationary imaging systems with additive noise, characteristic functions sufficient to reconstruct the signal and noise power distributions can be constructed. In practice many systems not conforming to these conditions can be approximated as linear, stationary imaging systems with additive noise having sufficient accuracy to enable the prediction of perceived image quality if not full image reconstruction.

Spatial characteristics of the elements of an image processing system or platform can be represented in at least two forms. In a first form, a characteristic processing section **30** of the image processing platform contains spatial characteristic functions describing added noise and image signal transform characteristics of the source and destination devices. In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, the characteristic processing section **30** contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. patent application Ser. No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation. This patent application is hereby incorporated in its entirety to provide supplemental background information which is non-essential but helpful in appreciating the applications of the present invention.

FIG. **2** is a detailed diagram of the image processor **4** of FIG. **1**. The image processor **4** includes a controller **15**, a characteristic processing section **30** and an image processing section **32**. The characteristic processing section **30** produces image processing data **17** in response to color source characteristic information **14**, spatial source characteristic information **12**, color destination device characteristic information **22**, spatial destination device characteristic information **20**, and a first control signal **13** from the controller **15**. In turn, the image processing section **32** produces a processed image signal **18** in response to the image processing parameter data **17**, an input image signal **16** and a second control signal **19** from the controller **4**. The controller **15** also generates both source device control data **8** and destination device control data **10**.

If I(x,y) represents the intensity distribution over the spatial coordinates (x,y) of the image and I(u,v) represents the corresponding frequency domain representation of the image constructed from the Fourier transform of I(x,y), then the transformation of the image by a linear, stationary imaging element can be represented as shown in FIG. 3. In the spatial domain the transformation is described by a Linear function S(g(x,y)):

$$I'(x,y)=S(I(x,y)) \tag{1}$$

$$I''(x,y)=S(I(x,y)+N(x,y)) \tag{2}$$

and in the Fourier (spatial frequency) domain by the Fourier Transform S(G(u,u)) of S(g(x,y)):

$$I(u,v)=S(I(u,v)) \tag{3}$$

$$I''(u,v)=S(I(u,v)+N(u,v)) \tag{4}$$

where N(x,y) and its corresponding Fourier Transform N(u,v) represents the additive noise.

For a linear, stationary imaging system, the transfer function S(g(x,y)) is given by

$$S(g(x,y))=s(x,y)\otimes g(x,y) \tag{5}$$

where $\otimes$ signifies convolution. S(G(u,v) is given by:

$$S(G(u,v)=S(u,v)*G(u,v) \tag{6}$$

where * signifies point multiplication.

In principle S(u,v) can be computed from the ratio of the output/input signal power distributions. In practice, S(u,v) is determined from fourier analysis of images of step input images via edge gradient analysis, or point or line images via point or line spread analysis. The transfer function is commonly called the Modulation Transfer Function (MTF).

If the input image is an uniform image $I(x,y)=I_0$, Fourier analysis of the output image will yield the Wiener Noise Power Spectrum N(u,v) which is the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

As stated previously, most real systems violate the criteria for being linear and stationary; and while introducing additive noise, that noise is often gray level dependent. This type of noise is referred to as non-linear, non-stationary, gray level dependent additive noise.

If a number of uniform field images, each described by a constant intensity I_y (where Y represents the luminance level) are processed by a device, Fourier analysis of the output images will yield Wiener Noise Power Spectra $N_y(u,v)$. The set of gray level dependent Wiener Noise Power Spectra represents the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

For non-linear image transforms a set of signal level dependent MTFs could, in principle, be generated to represent the characteristic functions describing the signal transform in the imaging device. In practice a single characteristic function can be generated from an ensemble average of MTFs or a small signal approximation. In general all of these characteristic functions are two-dimensional functions which are represented as M(u,v).

For non-stationary image transforms the image signal transform characteristic function can, in principle, be represented by a multi-dimensional function, M(x,y,u,v), generated from a local fourier analysis of the point spread function located at the position (x,y). In practice the characteristic function can be approximated by an ensemble average of the position dependent multi-dimensional function M(x,y,u,v).

$$M(u,v)=\langle M(x,y,u,v)\rangle_{xy} \tag{7}$$

where the operation $\langle M(x,y,u,v)\rangle_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y.

The processing of spatial characteristic functions in the image processing system of the preferred embodiment is model based. For a linear imaging system with additive noise, each image processing element is represented by a transfer function that is a model of the effect of that image processing element upon an image as shown in FIG. **4** and defined by equations (7) and (8) in the frequency domain.

$$M''(u,v)=Ki(u,v)*M(u,v) \tag{8}$$

$$N''(u,v)=Ki^2(u,v)*N(u,v)+Ni(u,v) \tag{9}$$

For non-linear imaging elements, the transfer function may be a more general representation of the characteristic func-

tions presented to the imaging element and evaluated in terms of a model of the imaging element.

Spatial characteristic functions are generated from fourier analysis of selected target images. Characteristic functions (a) may be scalar, one or two dimensional arrays for at least one of the device N channels, (b) are evaluated over the spatial frequency range 0 to the Nyquist frequency in equal frequency intervals, and (c) for source devices may be stated either in a proprietary processing space or in device independent space.

In the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format, as described in the ICC Profile Specification, version 3. 10b dated Oct. 21, 1995. The tagged format should include information as to which class the particular characteristic function belongs, i.e. Modulation Transfer Functions, Wiener Noise Power Spectra, or gray level dependent Wiener noise masks. The tagged format should also include information sufficient to identify both the relevant units of spatial frequency and the dimensionality of the characteristic functions. Propagation of characteristic functions is calculated within the context of the model based image processing system.

It is to be understood that the above described embodiments are merely illustrative of the present invention and represent a limited number of the possible specific embodiments that can provide applications of the principles of the invention. Numerous and varied other arrangements may be readily devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention as claimed.

What is claimed is:

1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.

2. The device profile of claim 1 wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

3. The device profile of claim 2, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

4. The device profile of claim 1, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

5. The device profile of claim 1, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

6. The device profile of claim 5, wherein said gray level dependent additive noise is spatially dependent.

7. The device profile of claim 1, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

8. The device profile of claim 7, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

9. The device profile of claim 1 wherein, for said device, the second data is generated through use of spatial stimuli and device response characteristic functions.

10. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;

generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and

combining said first and second data into the device profile.

11. The method of claim 10 wherein, for said device:

said second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

12. The method of claim 11 wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

13. The method of claim 11 wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

14. The method of claim 11, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

15. The method of claim 13, wherein said gray level dependent additive noise is spatially dependent.

16. The method of claim 11, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

17. The method of claim 16, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

18. A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space through use of chromatic response characteristic functions; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device independent color space through the use of spatial characteristic functions describing image spatial transform characteristics in said device independent color space.

19. The system of claim 18, wherein the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

20. The system of claim 19, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

21. The system of claim 18, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

22. The system of claim 18, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

23. The system of claim 22, wherein said gray level dependent additive noise is spatially dependent.

24. The system of claim 18, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

25. The system of claim 24, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

26. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

27. The device profile of claim 26 wherein, for said device, the data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

28. The device profile of claim 27, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

29. The device profile of claim 26, wherein the data is represented by characteristic functions describing a gray level dependent additive noise in said device.

30. The device profile of claim 26, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

31. The device profile of claim 30, wherein said gray level dependent additive noise is spatially dependent.

32. The device profile of claim 26, wherein the data is represented by characteristic functions describing spatially dependent additive noise in said device.

33. The device profile of claim 32, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

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PATENT APPLICATION SERIAL NO. 08/709487

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PATENT AND TRADEMARK OFFICE
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION

OF

BROR O. HULTGREN III
F. RICHARD COTTRELL
AND
JAY E. THORNTON

FOR

DEVICE PROFILES FOR USE IN

A DIGITAL IMAGE PROCESSING SYSTEM

08/709487

8166 PATENT

ABSTRACT OF THE DISCLOSURE

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

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8166 PATENT

DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed generally towards digital image processing and more specifically towards generation and use of an improved device profile for describing both spatial and color properties of a device within an image processing system, so that a processed image can be more accurately captured, transformed or rendered.

2. Description of the Prior Art

Digital image processing involves electronically capturing an image of a scene, altering the captured image in some desired fashion and passing the altered image to an output device. An upstream element of a digital image processing system can be thought of as a source device, whereas a downstream element can be thought of as a destination device. For instance, a simple image processing system could include an acquisition device such as a digital camera, camcorder, scanner, CCD, etc., a color processor for processing the colors of the image, and an output device, such as a printer, monitor, computer memory, etc. When considering a communication between the acquisition device and the color processor, the acquisition device is deemed as the source device whereas the color processor is deemed as the destination device. When considering a communication between the color processor and the output device, the color processor is deemed as the source device whereas the output device is deemed as the destination device.

All imaging devices, either image acquisition or image display, will impose distortions of the color and spatial components of the image data.

Historically, industry has chosen to correct these distortions with device dependent solutions. It is common practice in the industry that an integral part of the

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design and calibration of such devices is the characterization of these distortions in the image data and modifications of the design of the devices to ameliorate these distortions. For example, electronic peaking filters are often employed in video capture devices to correct for the blurring effects of anti-aliasing filters and amplifier frequency response. Electronic imaging devices are commonly designed to function with specific upstream (in the case of display devices) or downstream (in the case of image sources) devices to provide quality images. For example, image capture devices commonly transform the image digits to compensate ('gamma corrected') for the CRT volts-luminance characteristics of CRT displays. Such design considerations provide a device dependent model for that specific implementation of an image processing system, but do not provide the same degree of image quality when substituting an alternative device.

Recently, device independent paradigms for the characterization of color information in an image processing system have been developed and are being implemented: Color Sync, developed by Apple Computer and KCMS, developed by Eastman Kodak Co., are examples of systems or components supporting a device independent color paradigm. This paradigm is based upon a characterization of the image pixel data (digits) in a device independent color space -- e.g. CIE L*a*b* or CIE XYZ, and the use of a Color Management System. The characterization of a device's image pixel data in device independent color space is commonly codified in a tagged file structure, referred to as a device profile, that accompanies the digital imaging device. However, the spatial characteristics of digital imaging devices are still modified in the context of the device dependent model described above.

In order to improve processing flexibility and versatility, it is a primary object of the present invention to apply a device independent paradigm to spatial processing in a digital image processing system. This paradigm will

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capture the spatial characterization of the imaging device in a tagged file format, referred to as a device spatial profile.

SUMMARY OF THE INVENTION

Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured response chromatic and spatial stimuli and device response ~~characteristic functions~~ within a model based image processing system to predict both color and spatial characteristic ~~of~~ functions of ~~characteristics of a processed image~~ an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

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BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned aspects and other features of the invention are described in detail in conjunction with the accompanying drawings in which the same reference numerals are used throughout for denoting corresponding elements and wherein:

Figure 1 is a block diagram of a basic digital image processing system according to the invention;

Figure 2 is a detailed block diagram of the image processor of Figure 1;

Figure 3 is a model of characteristic functions sufficient to reconstruct signal and noise power distributions for linear, stationary image systems having additive noise; and

Figure 4 is a model of the effect of an image processing element upon an image.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A simplified version of a digital image processing system is shown in the block diagram of Figure 1. The acquisition device 2, for instance a digital camera, acquires an image which is represented as the input image signal 16. The image processor 4 receives the input image signal 16, acquisition device spatial characteristic information 12 and acquisition device color characteristic information 14 in response to a control signal 8. The image processor 4 also receives output device spatial characteristic information 20 and output device color characteristic information 22 from the output device 6 in response to a control signal 10. After processing the input image signal 16 in accordance with all the signals received by the processor 4, the image processor 4 sends the processed image signal 18 to output device 6, for instance a printer which produces a hardcopy of the processed image.

An image includes both spatial and chromatic information. The spatial content of an image can be described by its signal and noise power distributions. An image's signal or noise power distribution will be transformed by a device but does not give an unique description of the device because the distributions are image specific and they will be determined by the result of all preceding image transformations. However for one class of imaging devices namely linear, stationary imaging systems with additive noise, characteristic functions sufficient to reconstruct the signal and noise power distributions can be constructed. In practice many systems not conforming to these conditions can be approximated as linear, stationary imaging systems with additive noise having sufficient accuracy to enable the prediction of perceived image quality if not full image reconstruction.

Spatial characteristics of the elements of an image processing system or platform can be represented in at least two forms. In a first form, a characteristic processing section 30 of the image processing platform contains spatial characteristic functions describing added noise and image signal transform characteristics of the

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source and destination devices. In practice these image signal transform characteristics are represented by mid-tone Wiener Noise Spectra and small signal Modulation Transfer Functions measured in the mid-tone domain. In a second form, the characteristic processing section 30 contains spatial characteristic functions describing a gray level dependent additive noise in the source device. The latter form is directed towards the method(s) described in U.S. Patent Application No. 08/440,639 filed May 15, 1995 for noise reduction using a Wiener variant filter in a pyramid image representation. This patent application is hereby incorporated in its entirety to provide supplemental background information which is non-essential but helpful in appreciating the applications of the present invention.

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If I(x,y) represents the intensity distribution over the spatial coordinates (x,y) of the image and $\mathcal{I}(u,v)$ represents the corresponding frequency domain representation of the image constructed from the Fourier transform of I(x,y), then the transformation of the image by a linear, stationary imaging element can be represented as shown in Figure 3. In the spatial domain the transformation is described by a Linear function S(g(x,y)):

$$I'(x,y) = S(I(x,y)) \tag{1}$$

$$I''(x,y) = S(I(x,y) + N(x,y)) \tag{2}$$

and in the Fourier (spatial frequency) domain by the Fourier Transform $\mathcal{S}(\mathcal{G}(u,v))$ of S(g(x,y)):

$$\mathcal{I}(u,v) = \mathcal{S}(\mathcal{I}(u,v)) \tag{3}$$

$$\mathcal{I}''(u,v) = \mathcal{S}(\mathcal{I}(u,v) + \mathcal{N}(u,v)) \tag{4}$$

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where N(x,y) and its corresponding Fourier Transform $\mathcal{N}(u,v)$ represents the additive noise.

For a linear, stationary imaging system, the transfer function S(g(x,y)) is given by

$$S(g(x,y)) = s(x,y) \otimes g(x,y) \qquad (5)$$

where ⊗ signifies convolution. $\mathcal{S}(\mathcal{G}(u,v)$ is given by:

$$\mathcal{S}(\mathcal{G}(u,v) = \mathcal{S}(u,v) * \mathcal{G}(u,v) \qquad (6)$$

where * signifies point multiplication.

In principle $\mathcal{S}(u,v)$ can be computed from the ratio of the output/input signal power distributions. In practice, $\mathcal{S}(u,v)$ is determined from fourier analysis of images of step input images via edge gradient analysis, or point or line images via point or line spread analysis. The transfer function is commonly called the Modulation Transfer Function (MTF).

If the input image is an uniform image $I(x,y) = I_0$, Fourier analysis of the output image will yield the Wiener Noise Power Spectrum $\mathcal{N}(u,v)$ which is the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

As stated previously, most real systems violate the criteria for being linear and stationary; and while introducing additive noise, that noise is often gray level dependent. This type of noise is referred to as non-linear, non-stationary, gray level dependent additive noise.

If a number of uniform field images, each described by a constant intensity I_Y (where Y represents the luminance level) are processed by a device, Fourier analysis of the output images will yield Wiener Noise Power Spectra $\eta_Y(u,v)$. The set of gray level dependent Wiener Noise Power Spectra represents the characteristic function for the imaging device describing the noise added to the image during its transformation through the imaging device.

For non-linear image transforms a set of signal level dependent MTFs could, in principle, be generated to represent the characteristic functions describing the signal transform in the imaging device. In practice a single characteristic function can be generated from an ensemble average of MTFs or a small signal approximation. In general all of these characteristic functions are two-dimensional functions which are represented as M(u,v).

For non-stationary image transforms the image signal transform characteristic function can, in principle, be represented by a multi-dimensional function, M(x,y,u,v), generated from a local fourier analysis of the point spread function located at the position (x,y). In practice the characteristic function can be approximated by an ensemble average of the position dependent multi-dimensional function M(x,y,u,v).

$$M(u,v) = \langle M(x,y,u,v)\rangle_{xy} \qquad (7)$$

where the operation $\langle M(x,y,u,v)\rangle_{xy}$ is a weighted average of the function M(x,y,u,v) over the spatial coordinates x,y.

The processing of spatial characteristic functions in the image processing system of the preferred embodiment is model based. For a linear imaging system with additive noise, each image processing element is represented by a transfer function that is a model of the effect of that image processing element upon an

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image as shown in Figure 4 and defined by equations (7) and (8) in the frequency domain.

$$\hat{M}''(u,v) = \hat{K}'(u,v) * M(u,v) \quad (8)$$

$$N''(u,v) = K_1^2(u,v) * N(u,v) + \hat{N}'(u,v) \quad (9)$$

For non-linear imaging elements, the transfer function may be a more general representation of the characteristic functions presented to the imaging element and evaluated in terms of a model of the imaging element.

Spatial characteristic functions are generated from fourier analysis of selected target images. Characteristic functions (a) may be scalar, one or two dimensional arrays for at least one of the device N channels, (b) are evaluated over the spatial frequency range 0 to the Nyquist frequency in equal frequency intervals, and (c) for source devices may be stated either in a proprietary processing space or in device independent space.

In the present invention, spatial characteristic functions are incorporated into device profiles. These spatial characteristic functions have been coded as private tags attachable to the well known International Color Consortium (ICC) profile format, as described in the ICC Profile Specification, version 3.10b dated October 21, 1995. The tagged format should include information as to which class the particular characteristic function belongs, i.e. Modulation Transfer Functions, Wiener Noise Power Spectra, or gray level dependent Wiener noise masks. The tagged format should also include information sufficient to identify both the relevant units of spatial frequency and the dimensionality of the characteristic functions. Propagation of characteristic functions is calculated within the context of the model based image processing system.

It is to be understood that the above described embodiments are merely illustrative of the present invention and represent a limited number of the possible

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specific embodiments that can provide applications of the principles of the invention. Numerous and varied other arrangements may be readily devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention as claimed.

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CLAIMS:

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1. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image; and

second data for describing a device dependent transformation of spatial information content of the image.

2. The device profile of claim 1 wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

3. The device profile of claim 2, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

4. The device profile of claim 1, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

5. The device profile of claim 1, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

6. The device profile of claim 5, wherein said gray level dependent additive noise is spatially dependent.

7. The device profile of claim 1, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

8. The device profile of claim 7, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

Sub B3

9. A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image in response to a color characteristic function describing added noise characteristics;

generating second data for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image signal transform characteristics; and

combining said first and second data into the device profile.

5.6 (4)

10. The method of claim 9 wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

11. The method of claim 9 wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

12 The method of claim 9, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

15 ~~13~~. The method of claim ~~11~~ 13, wherein said gray level dependent additive noise is spatially dependent.

5.5 (5)

14. The method of claim 9, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

~~15~~. 17 The method of claim ~~14~~ 16, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

Sub B3

16. A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

13

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image in response to a color characteristic function describing added noise characteristics; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image signal transform characteristics.

19 ~~17~~. The system of claim ~~16~~ 18, wherein the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

20 ~~18~~. The system of claim ~~17~~ 19, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

21 ~~19~~. The system of claim ~~16~~ 18, wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

22 ~~20~~. The system of claim ~~16~~ 18, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

23 ~~21~~. The system of claim ~~20~~ 22, wherein said gray level dependent additive noise is spatially dependent.

24 ~~22~~. The system of claim ~~16~~ 18, wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

25 ~~23~~. The system of claim ~~22~~ 24, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

24. A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image.

27 ~~25~~. The device profile of claim ~~24~~ 26 wherein, for said device, the data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics.

28 ~~26~~. The device profile of claim ~~25~~ 27, wherein said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

29 ~~27~~. The device profile of claim ~~24~~ 26, wherein the data is represented by characteristic functions describing a gray level dependent additive noise in said device.

30 ~~28~~. The device profile of claim ~~24~~ 26, wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

31 ~~29~~. The device profile of claim ~~28~~ 30, wherein said gray level dependent additive noise is spatially dependent.

32 ~~30~~. The device profile of claim ~~24~~ 26, wherein the data is represented by characteristic functions describing spatially dependent additive noise in said device.

33 ~~31~~. The device profile of claim ~~30~~ 32, wherein said spatially dependent additive noise is represented by Wiener Noise Spectra.

A1d(r)

8166

PATENT

08/709,489

DECLARATION AND POWER OF ATTORNEY

As below named inventors, we hereby declare that:

Our residence, post office address and citizenship are as stated below next to our names;

We believe we are the original, first and sole inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM, the specification of which is attached hereto;

We have reviewed and understand the contents of the above identified specification, including the claims;

We acknowledge the duty to disclose information material to the patentability of the claims as defined in Title 37, Code of Federal Regulations, §1.56(a);

1 We appoint Robert A. Sabourin, Reg. No. 35,344 c/o Polaroid Corporation, Patent Department, 549 Technology Square, Cambridge, Massachusetts 02139, as our attorney with full power of substitution, and revocation, to prosecute this application, to make alterations and amendments therein, to receive the Letters Patent, and to transact all business in the Patent Office connected therewith; and

All statements made herein of our own knowledge are true and all statements made on information and belief are believed to be true; and further these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00

Full name of first inventor Bror O. Hultgren III

First Inventor's Signature Bror O. Hultgren III

Date September 6, 1996

Residence 6 Jeffrey's Neck Road, Ipswich, MA 01938

Citizenship United States of America MA

Post Office Address same as above

2-00

Full name of second joint inventor F. Richard Cottrell

Second Inventor's Signature F. Richard Cottrell

Date September 6, 1996

Residence 49 Kennedy Circle, Easton, MA 02375

Citizenship United States of America MA

Post Office Address same as above

3-00

Full name of second joint inventor Jay E. Thornton

Second Inventor's Signature Jay E. Thornton

Date September 6, 1996

Residence 56 Lincoln Street, Watertown, MA 02172 MA

Citizenship United States of America

Post Office Address same as above

Assignment Document

While copying your file we noticed that the Application Transmittal letter states that an assignment document was originally filed with this case.
At your request, we will attempt to obtain the assignment documents from the assignment branch located within the USPTO. Please note that additional charges will apply to this service.

08/709487

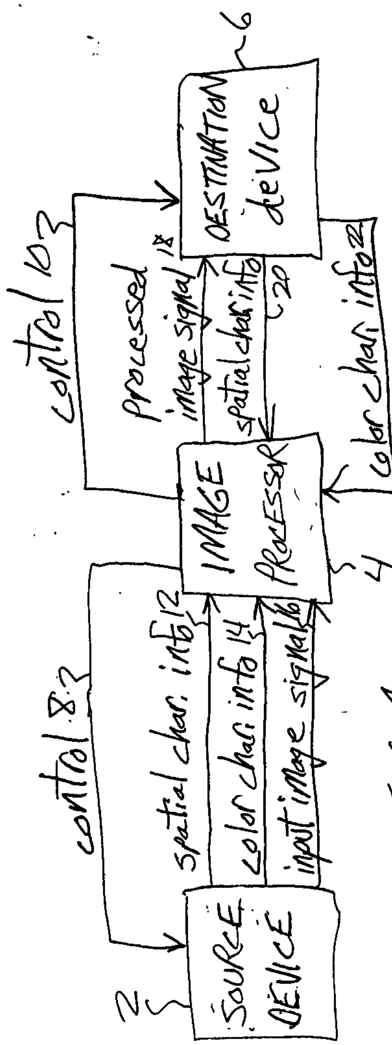

FIG. 1

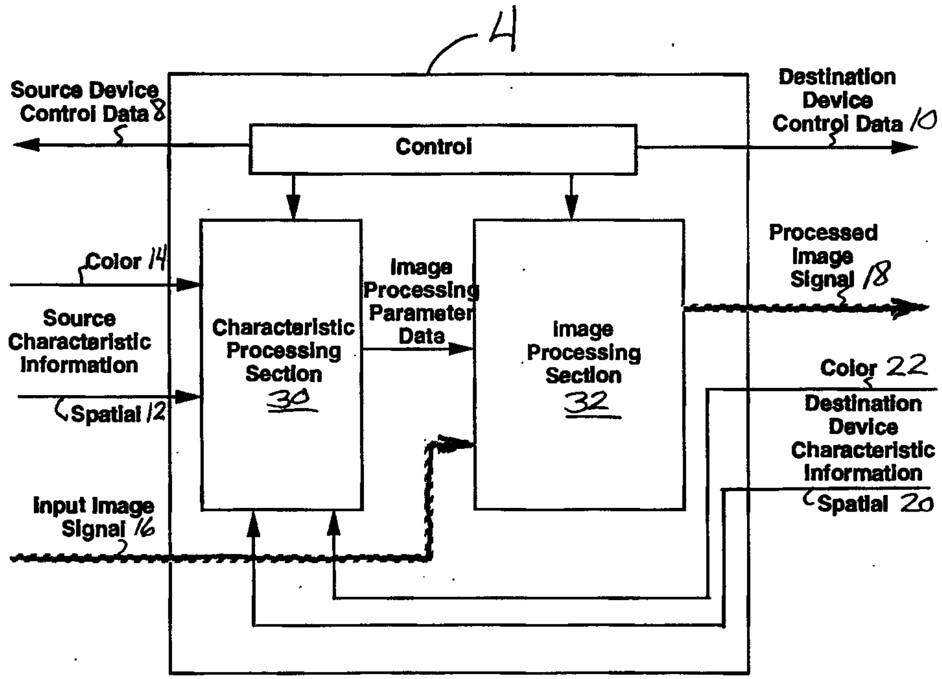
4
Source Device Control Data 8
Control
Destination Device Control Data 10
Color 14
Source Characteristic Information
Spatial 12
Characteristic Processing Section 30
Image Processing Parameter Data
Image Processing Section 32
Processed Image Signal 18
Color 22
Destination Device Characteristic Information
Spatial 20
Input Image Signal 16

FIG 2.

08/709487

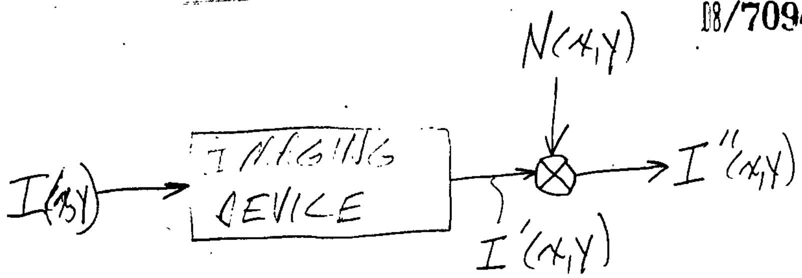

FIG. 3

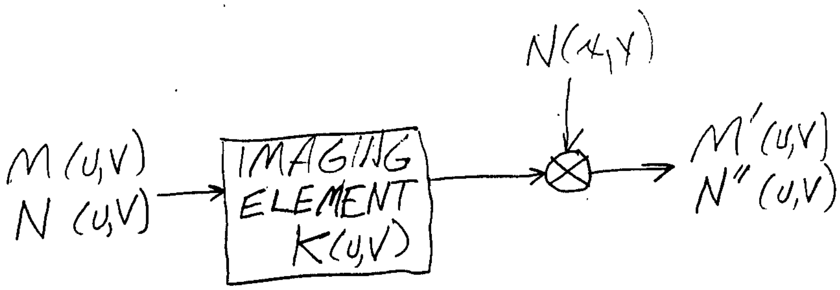

FIG. 4

08/709487

MAIL ROOM SEP 6 1996 PAT. & TRADEMARK OFF.

POLAROID CORPORATION
575 TECHNOLOGY SQUARE - 3RD FLOOR
CAMBRIDGE, MASSACHUSETTS 02139 U.S.A.

ROBERT A. SABOURIN
PATENT ATTORNEY

TEL: 617-386-6413
FAX: 617-386-6435
NET: sabourr@polaroid.com

TRANSMITTAL LETTER

Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

September 6, 1996

Our File No. 8166 (RAS)

Sir:

Enclosed herewith are a 9 page specification, abstract, 4 pages of claims, 3 pages of drawings, a Declaration and Power of Attorney, Assignment, Form PTO-1595, a Certificate of Express Mailing, and a postcard in connection with an application of Bror O. Hultgren III, et al. for a patent entitled DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

There is also enclosed a check (check no. 15885) to cover the cost of filing the application and recording the assignment, as follows:

Basic Fee	$ 750.00
Additional Fees:	
Total number of claims in excess of 20, times $22	$ 242.00
Number of independent claims minus 3, times $78	$ 78.00
Multiple dependent claims, times $250	$ 0.00
Total Filing Fee	$1070.00
Assignment Recording Fee	$ 40.00
Total Enclosed	$1110.00

It is respectfully requested that the Deposit Account of Polaroid Corporation (Account No. 16-2195) be credited with any excess filing fee or charged for any deficiency in filing fee.

Please address all communications from the Patent Office in connection with this application to Polaroid Corporation, Patent Department, 549 Technology Square, Cambridge, Massachusetts 02139.

Respectfully,

Robert A. Sabourin

Robert A. Sabourin
Registration No. 35,344

08/709487

MAIL ROOM SEP 6 1996 PAT. & TRADEMARK OFF.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Bror O. Hultgren III et al.	Group: not yet assigned	
Serial No.:	not yet assigned	Examiner:	not yet assigned
Filed:	September 6, 1996		
For:	DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM		

EXPRESS MAILING CERTIFICATION

Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

Sir:

I hereby certify that a 9 page specification, a one page abstract, 4 pages of claims, 3 pages of drawings, a Transmittal Letter, a Declaration and Power of Attorney, Form PTO-1595, an Assignment, check no. 15885 in the amount of $1,110.00 and a postcard is being deposited on September 6, 1996 with the United States Postal Service with sufficient postage as Post Office Express Mail to Addressee No. EH303475732US in an envelope addressed to: Assistant Commissioner for Patents, Box Patent Application, Washington, D.C. 20231.

Respectfully,

Jennifer Einstein

Jennifer Einstein

2606

#2
I2
4-11-97

MAIL ROOM MAR 24 1997 PAT. & TRADEMARK OFF.

8165
62

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Bror O. Hultgren III et al.	Group:	2606
Serial No.:	08/709,487	Examiner:	not yet assigned
Filed:	September 6, 1996		
For:	DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM		

GROUP 2600

97 APR -9 PM 2:42

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner for Patents
Box DD
Washington, D.C. 20231

March 19, 1997

Sir:

In accordance with 37 C.F.R. §§1.63, 1.97 and 1.98, Applicant lists, provides copies, and provides concise explanations of the following reference.

ICC Profile Format Specification, Version 3.10b, October 21, 1995 describes standards for conventional device profiles to be adopted in an international standard by the International Color Consortium.

No fee is due since this Information Disclosure Statement is being filed before receipt of a first Office Action on the merits.

Respectfully submitted,

Robert A. Sabourin

Robert A. Sabourin
Attorney Reg. No. 35,344

Polaroid Corporation
Patent Department
575 Technology Square - 3rd Floor
Cambridge, MA. 02139

Tel: (617) 386-6413
RAS/jme

MAILING CERTIFICATION

I hereby certify that this correspondence is being deposited on March 19, 1997 with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Box DD, Washington, D.C. 20231.

Jennifer Einstein

Jennifer Einstein

C-8166 Page 1 of 1

CMB No. 0651-0011

Form PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE INFORMATION DISCLOSURE CITATION	ATTY. DOCKET NO. C8166 (RAS)	SERIAL NO. 08/709,487
	APPLICANT Bror O. Hultgren III et al.	
(Use Several Sheets If Necessary)	FILING DATE September 6, 1996	GROUP ~~2806~~ 2721

MAIL ROOM MAR 24 1997 PAT. & TRADEMARK OFFICE

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUB-CLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

VG	ICC Profile Format Specification, Version 3.10b, October 21, 1995

EXAMINER	DATE CONSIDERED
Daniel G. Marian	12-1-97

*EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form PTO-FB-A820 (also form PTO-1449)

Patent and Trademark Office - U.S. DEPARTMENT OF COMMERCE

EXHIBIT B
PAGE 49

8166

PATENT #13/a J. Hall 6-12-97

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl'n. of:	Hultgren et al.	Group:	2606
Serial No.:	08/709,487	Examiner:	not yet assigned
Filed:	September 9, 1996		
For:	DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM		

RECEIVED JUN 12 97 GROUP 2600

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Box Non-Fee Amendment
Washington, D.C. 20231

May 21, 1997

Sir:

Entry of the following amendments prior to examination and consideration is requested.

IN THE SPECIFICATION

Please amend the specification as follows.

Page 4, line 26, after "section" insert --30--;

page 5, line 4, after "section" insert --30--;

between lines 10 and 11, insert

-- Figure 2 is a detailed diagram of the image processor 4 of Figure 1. The image processor 4 includes a controller 15, a characteristic processing section 30 and an image processing section 32. The characteristic processing section 30 produces image processing data 17 in response to color source characteristic information 14, spatial source characteristic information 12, color destination device characteristic information 22, spatial destination device characteristic information 20, and a first control signal 13 from the controller 15. In turn, the image processing section 32 produces a processed image signal 18 in response to the image processing parameter data 17, an input image signal 16 and a second control signal 19

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8166 PATENT

from the controller 4. The controller 15 also generates both source device control data 8 and destination device control data 10.--

REMARKS

The specification has been amended to clearly recite the elements as shown in Figure 2. No new subject matter has been added to the specification.

No fees are due with this response.

In view of the foregoing Amendments, this Application is in condition for examination. Should questions arise during examination, Examiner is requested to contact Applicant's attorney at the telephone number listed below.

Respectfully submitted,

Robert A. Sabourin
Attorney Reg. No. 35,344

Polaroid Corporation
Patent Department
575 Technology Square - 3rd Floor
Cambridge, MA. 02139

Tel: (617) 386-6413
RAS/pc

MAILING CERTIFICATION

I hereby certify that this correspondence is being deposited on May 21, 1997 with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Box Non-Fee Amendments, Washington, D.C. 20231.

Jennifer Einstein

17 2

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
08/709,487	09/06/96	HULTGREN	B 8166(RAS)

LM32/1210

POLAROID CORPORATION
PATENT DEPARTMENT
549 TECHNOLOGY SQUARE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM,D	
ART UNIT	PAPER NUMBER
2721	4

DATE MAILED: 12/10/97

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

OFFICE ACTION SUMMARY

☐ Responsive to communication(s) filed on ______.

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 D.C. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-31 is/are pending in the application.
Of the above, claim(s) ______ is/are withdrawn from consideration.
☐ Claim(s) ______ is/are allowed.
☒ Claim(s) 1-31 is/are rejected.
☐ Claim(s) ______ is/are objected to.
☐ Claim(s) ______ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
☐ The drawing(s) filed on ______ is/are objected to by the Examiner.
☐ The proposed drawing correction, filed on ______ is ☐ approved ☐ disapproved.
☐ The specification is objected to by the Examiner.
☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.
☐ received in Application No. (Series Code/Serial Number) ______.
☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______.

☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of Reference Cited, PTO-892
☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 2
☐ Interview Summary, PTO-413
☒ Notice of Draftperson's Patent Drawing Review, PTO-948
☐ Notice of Informal Patent Application, PTO-152

--SEE OFFICE ACTION ON THE FOLLOWING PAGES--

326 (Rev. 9/96)

EXHIBIT B
PAGE 52

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 9, 16, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Laumeyer et al (5,572,632) in view of Spiegel et al (5,615,282).

With regard to claim 1, Laumeyer et al discloses first data for describing a device dependent transformation of color information content of the image (column 4, lines 34-42). Laumeyer et al does not explicitly call for describing a device dependent transformation of color information content. However, Spiegel et al discloses an apparatus and techniques for processing of data such as color images comprising, ***spatial processing: detecting and/or transforming the spatial characteristics of a representation of a color image*** which may pertain to at least the characteristics of the representation of the color image and/or to the mutual relationship between adjacent portions of the color image. For example: change of format (e.g. LW to CT), change of

resolution, filtering including edge detection and processing, blur/sharp functions, etc., and combinations of these operations. . . . . .color value: a representation of a color, typically in a color coordinate system such as but not limited to RGB, L*a*b*, XYZ coordinate systems and *device dependent* coordinate systems such as color head signals e.g. RGB, ink percentages e.g. CMYK, etc. (Column 33, line 44 through column 34, line 8).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Spiegel et al into Laumeyer et al's system in order to transform the spatial characteristic of the color image.

Claim 9 is rejected the same as claim 1. Thus, argument analogous to that presented above for claim 1 is applicable to claim 9. As to combining the first and second data into the device profile, Laumeyer et al further discloses This two-stage process is used to transform input color specifications into device-dependent color specifications which then are stored in a frame buffer. That frame buffer stores ***device-dependent information***, such as CMYK or RGB color values, ***in describing the output image pixel data which are used to form the output signals*** controlling the printing of that printer to thereby have the print engine therein correctly set the fractions of maximum toner or ink densities that it is to provide on the selected device.

Claim 16 is rejected the same as claim 1 except claim 16 is an apparatus claim. Thus, argument analogous to that presented above for claim 1 is applicable to claim 16.

Claim 24 is rejected the same as claim 1. Thus, argument similar to that presented above for claim 1 is applicable to claim 24.

3. Claims 2-8, 10-15, 17-23 and 25-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Laumeyer et al in view of Spiegel et al as applied to claims 1, 9, 16, and 24 above, and further in view of Cottrell et al (5,694,484).

With regard to claim 2, Laumeyer et al (as modified by Spiegel et al) discloses all the claimed subject matter except explicitly calling for a first characteristic function describing added noise characteristics. However, Cottrell et al discloses system consists of a set of image-processing operations, an architecture, and an intelligent control. These elements take into consideration profiles of sources from which the images are generated, profiles of intended applications, and the impact that image processing operations (individually or in concert) will have on perceived image quality. The analysis uses a body of relationships linking human perception of image quality with objective metrics (such as sharpness, grain, tone, and color) of image content (abstract); and the characteristic processing section 21 generates the image processing parameter data to be used by the image data processing section 20 in processing the image data in relation to the specific device or methodology used to acquire the image data, and the ***specific device*** or methodology to be used. . . . . for a multi-color imaging system, ***modulation transfer functions MTF(f) are determined separately for each color. The Wiener spectrum***

characterizes the noise in the image, including that noise introduced with the original data provided by image data source 11, ***noise added*** or removed in successive processing operations in image data processing section 20, and noise introduced during rendering by the downstream utilization element. The Wiener spectrum is most easily evaluated by observing the data fluctuations in the rendered image in the case that a uniform source image is presented to the system (column 18, lines 3-52).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Cottrell et al into Laumeyer et al's (as modified by Spiegel et al) system if no other reason than to have a function describing an additive noise characteristics.

Claims 3, 7, and 8 are rejected the same as claims 1 and 2. Thus, arguments similar to those presented above for claims 1 and 2 are applicable to claims 3, 7, and 8.

With regard to claim 4, Cottrell et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Johnston et al (US 5,682,442) Image-Processing System; Doi et al (US 5,224,177) High Quality Film Image Correction and Duplication Method and System.

Effective November 16, 1997, the Examiner handling this application will be assigned to a new Art Unit as a result of the consolidation into Technology Center 2700. See the forth coming Official Gazette notice dated November 11, 1997. For any written or facsimile communication submitted ON OR AFTER November 16,1997, this Examiner, who was assigned to Art Unit **2616**, will be assigned to Art Unit **2721**. Please include the new Art Unit in the caption or heading of any communication submitted after the November 16,1997 date. Your cooperation in this matter will assist in the timely processing of the submission and is appreciated by the Office.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

December 2, 1997

LEO BOUDREAU
SUPERVISORY PATENT EXAMINER
GROUP 2600

Notice of References Cited	Application No. 08/709,487	Applicant(s) HULTGREN III, et al.
	Examiner Daniel G. Mariam	Group Art Unit 2721	Page 1 of 1

U.S. PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
	A	5,224,177	6-29-93	Doi et al.	382	266
	B	5,572,632	11-5-96	Laumeyer et al	395	116
	C	5,682,442	10-28-97	Johnston et al.	382	239
	D	5,615,282	3-25-97	Spiegel et al.	382	276
	E	5,894,484	12-02-97	Cottrell et al.	382	167
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
	N						
	O						
	P						
	Q						
	R						
	S						
	T						

NON-PATENT DOCUMENTS

*		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
	U		
	V		
	W		
	X		

* A copy of this reference is not being furnished with this Office action.
(See Manual of Patent Examining Procedure, Section 707.05(a).)

U.S. Patent and Trademark Office
PTO-892 (Rev. 9-95)

Part of Paper No. 4

*U.S. GPO: 1997-422-801/60010

Form PTO 948 (Rev. 10-94) U.S. DEPARTMENT OF COMMERCE - Patent and Trademark Office Application No. 709487

NOTICE OF DRAFTSPERSON'S PATENT DRAWING REVIEW

PTO Draftpersons review all originally filed drawings regardless of whether they are designated as formal or informal. Additionally, patent Examiners will review the drawings for compliance with the regulations. Direct telephone inquiries concerning this review to the Drawing Review Branch, 703-305-8404.

The drawings filed (insert date) 9/6/96, are
A._____ not objected to by the Draftsperson under 37 CFR 1.84 or 1.152.
B. X objected to by the Draftsperson under 37 CFR 1.84 or 1.152 as indicated below. The Examiner will require submissioo of new, corrected drawings when necessary. Corrected drawings must be submitted according to the instructions oo the back of this Notice.

1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings: Black ink. Color.
   - ___ Not black solid lines. Fig(s)_____
   - ___ Color drawings are oot acceptable uotil petition is granted. Fig(s)_____
2. PHOTOGRAPHS. 37 CFR 1.84(b)
   - ___ Photographs are not acceptable until petitioo is granted. Fig(s)_____
   - ___ Photographs ont properly mounted (must use brystol board or photographic dnuble-weight paper). Fig(s)_____
   - ___ Poor quality (half-tone). Fig(s)_____
3. GRAPHIC FORMS. 37 CFR 1.84 (d)
   - ___ Chemical or mathematical formula not labeled as separate figure. Fig(s)_____
   - ___ Group of waveforms oot preseoted as a single figure, using commoo vertical axis with time extending along horizootal axis. Fig(s)_____
   - ___ Individuals waveform not identified with a separate letter designation adjaceot to the vertical axis. Fig(s)_____
4. TYPE OF PAPER. 37 CFR 1.84(e)
   - ___ Paper oot flexible, strong, white, smooth, oonshiny, and durable. Sheet(s)_____
   - X Erasures, alterations, overwritings, interlineations, cracks, creases, and folds copy machine marks not accepted. Fig(s) 1-4
   - ___ Mylar, velum paper is not acceptable (too thin). Fig(s)_____
5. SIZE OF PAPER. 37 CFR 1.84(f): Acceptable sizes:
   21.6 cm. by 35.6 cm. (8 1/2 by 14 inches)
   21.6 cm. by 33.1 cm. (8 1/2 by 13 inches)
   21.6 cm. by 27.9 cm. (8 1/2 by 11 inches)
   21.0 cm. by 29.7 cm. (DIN size A4)
   - ___ All drawing sheets oot the same size. Sheet(s)_____
   - ___ Drawing sheet not an acceptable size. Sheet(s)_____
6. MARGINS. 37 CFR 1.84(g): Acceptable margins:

Paper size

	21.6 cm. X 35.6 cm. (8 1/2 X 14 inches)	21.6 cm X 33.1 cm. (8 1/2 X 13 inches)	21.6 cm. X 27.9 cm. (8 1/2 X 11 inches)	21.0 cm. X 29.7 cm. (DIN Size A4)
T	5.1 cm. (2")	2.5 cm. (1")	2.5 cm. (1")	2.5cm.
L	.64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	2.5 cm.
R	.64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	1.5 cm.
B	.64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	1.0 cm.

   - X Margins do not conform to chart above. Sheet(s) 2, 3
     ___ Top (T) X Left (L) ___ Right (R) ___ Bottom (B)
7. VIEWS. 37 CFR 1.84(h)
   REMINDER: Specification may require revision to correspond to drawing changes.
   - ___ All views not grouped together. Fig(s)_____
   - ___ Views connected by projectioo lines or lead lines. Fig(s)_____

   Partial views. 37 CFR 1.84(h) 2
   - ___ View and enlarged view not labled separatly or properly. Fig(s)_____

   Sectional views. 37 CFR 1.84 (h) 3.
   - ___ Hatching not indicated for sectional portions of an object. Fig(s)_____
   - ___ Cross section not drawn same as view with parts in cross section with regularly spaced parallel nblique strokes. Fig(s)_____
8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)
   - ___ Words do nnt appear on a horizontal, left-to-right fashion when page is either upright or turned so that the top becomes the right side, except for grapbs. Fig(s)_____
9. SCALE. 37 CFR 1.84(k)
   - ___ Scale not large eoough to show mechaoism with crowding wheo drawing is reduced io size to two-thirds in reproductioo. Fig(s)_____
   - ___ Indicatinn such as "actual size" or scale 1/2" oot permitted. Fig(s)_____
10. CHARACTER OF LINES, NUMBERS, & LETTERS. 37 CFR 1.84(l)
    - X Lines, numbers & letters not uniformly thick and well defined, clean, durable, and black (except for color drawings). Fig(s) 1-4
11. SHADING. 37 CFR 1.84(m)
    - ___ Solid black shading areas not permitted. Fig(s)_____
    - ___ Shade lioes, pale, rough and blurred. Fig(s)_____
12. NUMBERS, LETTERS, & REFERENCE CHARACTERS. 37 CFR 1.84(p)
    - X Numbers and reference characters not plaio and legible. 37 CFR 1.84(p)(1) Fig(s) 1-4
    - ___ Numbers and reference characters not oriented in same direction as the view. 37 CFR 1.84(p)(l) Fig(s)_____
    - ___ English alphabet not used. 37 CFR 1.84(p)(2) Fig(s)_____
    - ___ Numbers, letters, and reference characters do not measure at least .32 cm. (1/8 inch) in beight. 37 CFR(p)(3) Fig(s)_____
13. LEAD LINES. 37 CFR 1.84(q)
    - ___ Lead lines cross each other. Fig(s)_____
    - ___ Lead lines missing. Fig(s)_____
14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.84(t)
    - ___ Sheets not numbered consecutively, and in Arabic numerals, beginning with number 1. Sheet(s)_____
15. NUMBER OF VIEWS. 37 CFR 1.84(u)
    - ___ Views not numbered coosecutively, and in Arabic oumerals, begioning with number 1. Fig(s)_____
    - ___ View numbers oot preceded by the abbreviation Fig. Fig(s)_____
16. CORRECTIONS. 37 CFR 1.84(w)
    - ___ Correctinns not made from prior PTO-948. Fig(s)_____
17. DESIGN DRAWING. 37 CFR 1.152
    - ___ Surface shading sbown oot appropriate. Fig(s)_____
    - ___ Solid black shading not used for color contrast. Fig(s)_____

COMMENTS: - Character must not be cut thru by structure Fig 1,2

REVIEWER [signature] DATE 10/26/96

OFFICIAL

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3/12/98
JS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

FAX RECEIVED
MAR 11 1998
GROUP 2600

Group Art No. 2721
Examiner Daniel G. Mariam

Amendment

Bror O. Hultgren, III, et al.

Device Profiles For Use In A Digital Image Processing System

Serial No. 08/709,487

Filed: September 6, 1996

Certification of Facsimile Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office on the date shown below to Tel. No. (703) 308-5397.
March 10, 1998.

Name Donald F. Mofford Reg. No. 33,740

Signature Donald F. Mofford

Date March 10, 1998

Assistant Commissioner
of Patents
Washington, D. C. 20231

Dear Sir:

AMENDMENT

In response to the Office Action dated December 12, 1997, please amend the above-referenced application as follows:

In the Claims

Please amend Claims 1, 9, 16 and 24 as follows:

[redacted]

5.6(2) 1. (Amended) A device profile for ~~describing properties of a device in a digital image reproduction system~~ to capture, transform or render an image, said device profile comprising:

B first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing a device dependent transformation of spatial information content of the image to said device independent color space.

5.5(3) 9. (Amended) A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

B2 generating first data for describing a device dependent transformation of color information content of the image to a device independent color space in response to a color characteristic function describing added noise characteristics;

generating second data for describing a device dependent transformation of spatial information content of the image to said device independent color space in response to a spatial characteristic function describing image signal transform characteristics; and

combining said first and second data into the device profile.

3 5.6(4) 16. (Amended) A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

B means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space in

B3

response to a color characteristic function describing added noise characteristics; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image to said device independent color space ~~signal transform characteristics~~.

Sub C7

B4

24. (Amended) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space.

REMARKS

The above-identified patent application has been amended and reconsideration and re-examination are hereby requested.

Applicants note the required drawing changes, and formal replacement drawings incorporating the changes will be submitted thereafter.

The Examiner rejected Claims 1, 9, 16 and 24 under 35 U.S.C. § 103 as being unpatentable over Laumeyer et al (5,572,632) in view of Spiegel et al (5,615,282).

The Examiner also rejected Claims 2-8, 10-15,17-23 and 25-31 under 35 U.S.C. § 103 as being unpatentable over Laumeyer et al in view of Spiegel et al as applied to claims 1, 9, 16, and 24 and further in view of Cottrell et al (5,694,484).

It is respectfully submitted that Claim 1, as amended, is patentable over Laumeyer et al in view of Spiegel et al, since Laumeyer et al in view of Spiegel et al neither describe nor suggest "first data for describing a device dependent transformation of color information content of the

image to a device independent color space; and second data for describing a device dependent transformation of spatial information content of the image to said device independent color space".

Dependent Claim 2 adds the limitation "wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics" to claim a further patentably distinct feature of the invention.

As Claims 3 through 8 depend from Claim 1 and cite additional structure, they too are allowable for analogous reasons.

It is respectfully submitted that Claim 9, as amended, is patentable over Laumeyer et al in view of Spiegel et al, since Laumeyer et al in view of Spiegel et al neither describe nor suggest the method of "generating first data for describing a device dependent transformation of color information content of the image to a device independent color space in response to a color characteristic function describing added noise characteristics; generating second data for describing a device dependent transformation of spatial information content of the image to said device independent color space in response to a spatial characteristic function describing image signal transform characteristics; and combining said first and second data into the device profile."

As Claims 10 through 15 depend from Claim 9 and cite additional steps, they too are allowable for analogous reasons.

Independent Claim 16 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest the combination of

"means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space in *response to a color* characteristic function describing added noise characteristics; and means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image to said device independent color space signal transform characteristics."

As Claims 17 through 23 depend from Claim 16 and cite additional structure, they too are allowable for analogous reasons.

Claim 24 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest a "device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space."

As Claims 25 through 31 depend from Claim 24 and cite additional structure, they too are allowable for analogous reasons.

Applicants also believe that the remaining references cited by the Examiner but not applied to the Claims neither describe nor suggest Applicants' invention.

Accordingly, re-examination and reconsideration are requested in view of the above amendment and remarks.

Respectfully submitted,

Donald F. Mofford
Registration No. 33,740
Attorney for the Applicant(s)

Polaroid Corporation
575 Technology Square
Cambridge, MA 02139
(781) 386-6432
March 10, 1998
Case No. 8166
DFM/pc

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN B	8166(RAS)

LM32/0602

POLAROID CORPORATION
PATENT DEPARTMENT
549 TECHNOLOGY SQUARE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM,D	

ART UNIT	PAPER NUMBER
2721	

DATE MAILED: 06/02/98

6

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)
*U.S. GPO: 1997-422-199/60031

1- File Copy

Office Action Summary	Application No. 08/709,487	Applicant(s) Hultgren III, et al.
	Examiner Daniel G. Mariam	Group Art Unit 2721

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Response

A SHORTENED STATUTORY PERIOD FOR RESPONSE IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a response be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for response is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to respond within the set or extended period for response will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 3-11-98.

☒ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-31 is/are pending in the application.

Of the above claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) 1-31 is/are rejected.

☐ Claim(s) ______ is/are objected to.

☐ Claim(s) ______ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on ______ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☒ Notice of References Cited, PTO-892

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Interview Summary, PTO-413

☐ Notice of Informal Patent Application, PTO-152

☐ Other ______

Office Action Summary

U. S. Patent and Trademark Office
PTO-326 (Rev. 3-97)

*U.S. GPO: 1997-417-381/62710

Part of Paper No. 6

Response to Arguments

1. Applicant's arguments with respect to claims 1-31 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 9, 16 ~~and~~ 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman (5,668,890) in view of Spiegel, et al (5,615,282).

With regard to claim 1, Winkelman discloses a method and an apparatus for electronic reproduction of images comprising:

First data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of (minus-spatial information content) of the image to the device independent color space (col. 2, lines 46-55; col. 4, line 66 - col. 5, line 6; col. 6, lines 10-14). Winkelman does not explicitly call for a transforming operation using a spatial information content of the image. However, this is taught by Spiegel (col. 33, line 44 - col. 34, line 8).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Spiegel, et al into Winkelman's system in order to transform the spatial characteristic of the color image.

Claim 9 is rejected the same as claim 1. Thus, argument analogous to that presented above for claim 1 is applicable to claim 9. As to combining the first and second data into the device profile, Applicant's attention is directed to (Figure 2, ##, 16 and 17).

Claim 16 is rejected the same as claim 1 except claim 16 is an apparatus claim. Thus, argument analogous to that presented above for claim 1 is applicable to claim 16.

Claim 24 is rejected the same as claim 1. Thus, argument similar to that presented above for claim 1 is applicable to claim 24.

4. Claims 2-8, 10-15, 17-23 and 25-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman in view of Spiegel, et al as applied to claims 1, 9, 16, and 24 above, and further in view of Cottrell, et al (5,694,484).

With regard to claim 2, Winkelman (as modified by Spiegel, et al) discloses all the claimed subject matter except explicitly calling for a first characteristic function describing added noise characteristics. However, this is taught by Cottrell, et al (abstract; column 18, lines 3-52).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Cottrell et al into Winkelman's (as modified by Spiegel, et al) system if no other reason than to have a function describing an additive noise characteristics.

Claims 3, 7, and 8 are rejected the same as claims 1 and 2. Thus, arguments similar to those presented above for claims 1 and 2 are applicable to claims 3, 7, and 8.

With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Johnston et al (US 5,682,442) Image-Processing System; Doi et al (US 5,224,177) High Quality Film Image Correction and Duplication Method and System; US Patent No. (5,583,656) to Gandhi, et al discloses methods and apparatus for attaching compressed look-up table (LUT) representations of N to M-dimensional transforms to image data and for processing image data utilizing the attached compressed LUTs.

Effective November 16, 1997, the Examiner handling this application will be assigned to a new Art Unit as a result of the consolidation into Technology Center 2700. See the forth coming Official Gazette notice dated November 11, 1997. For any written or facsimile communication submitted ON OR AFTER November 16,1997, this Examiner, who was assigned to Art Unit **2616**, will be assigned to Art Unit **2721**. Please include the new Art Unit in the caption or heading of any communication submitted after the November 16,1997 date. Your cooperation in this matter will assist in the timely processing of the submission and is appreciated by the Office.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

May 11, 1998

LEO H. BOUDREAU
SUPERVISORY PATENT EXAMINER
GROUP 2700

02/07/00 10:51 FAX 781 386 8435 POLAROID PATENT DEPT. 002

Notice of References Cited	Application No. 08/709,487	Applicant(s) Hultgren III, et al	
	Examiner Daniel G Mariam	Group Art Unit 2721	Page 1 of 1

U.S. PATENT DOCUMENTS

	DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
A	5,583,658	12-10-96	Gandhi, et al	358	426
B	5,668,890	9-16-97	Winkelman	382	167
C					
D					
E					
F					
G					
H					
I					
J					
K					
L					
M					

FOREIGN PATENT DOCUMENTS

	DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
N						
O						
P						
Q						
R						
S						
T						

NON-PATENT DOCUMENTS

	DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
U		
V		
W		
X		

U. S. Patent and Trademark Office
PTO-892 (Rev. 9-95)

Notice of References Cited

Part of Paper No. 6

GAU 2721

Please type a plus sign (+) inside this box → [+]

PTO/SB/29 (1/98)
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OIPE SEP - 2 1998 PATENT & TRADEMARK OFFICE

CONTINUED PROSECUTION APPLICATION (CPA) REQUEST TRANSMITTAL

#7 9-10-98

Submit an original, and a duplicate for fee processing.
(Only for Continuation or Divisional applications under 37 CFR 1.53(d))

CHECK BOX, if applicable: ☐ DUPLICATE

Address to: **Assistant Commissioner for Patents** **Box CPA** **Washington, DC 20231**	*Attorney Docket No.*	8166
	First Named Inventor	Bror O. Hultgren, III
	Examiner Name	D. Mariam
	Group / Art Unit	2721
	Express Mail Label No.	

This is a request for a ☒ continuation or ☐ divisional application under 37 C.F.R. § 1.53(d), (continued prosecution application (CPA)) of prior application number 08 / 709,487, filed on September 06, 1996, entitled Device Profiles For Use In A Digital Image Processing System.

NOTES

FILING QUALIFICATIONS: *The prior application identified above must be a nonprovisional application that is either: (1) complete as defined by 37 C.F.R. § 1.51(b), or (2) the national stage of an international application in compliance with 35 U.S.C. 371.*
A Notice will be placed on a patent issuing from a CPA, except for reissues and designs, to the effect that the patent issued on a CPA and is subject to the twenty-year patent term provisions of 35 U.S.C. § 154(a)(2). Therefore, the prior application of a CPA may have been filed before, on or after June 8, 1995.

C-I-P NOT PERMITTED: *A continuation-in-part application cannot be filed as a CPA under 37 C.F.R. § 1.53(d), but must be filed under 37 C.F.R. § 1.53(b).*

EXPRESS ABANDONMENT OF PRIOR APPLICATION: *The filing of this CPA is a request to expressly abandon the prior application as of the filing date of the request for a CPA. 37 C.F.R. § 1.53(b) must be used to file a continuation, divisional, or continuation-in-part of an application that is not to be abandoned.*

ACCESS TO PRIOR APPLICATION: *The filing of this CPA will be construed to include a waiver of confidentiality by the applicant under 35 U.S.C. 122 to the extent that any member of the public who is entitled under the provisions of 37 C.F.R. § 1.14 to access to, copies of, or information concerning, the prior application may be given similar access to, copies of, or similar information concerning, the other application or applications in the file jacket.*

35 U.S.C. 120 STATEMENT: *In a CPA, no reference to the prior application is needed in the first sentence of the specification and none should be submitted. If a sentence referencing the prior application is submitted, it will not be entered. A request for a CPA is the specific reference required by 35 U.S.C. 120 and to every application assigned the application number identified in such request. 37 C.F.R. § 1.78(a).*

1. ☐ Enter the unentered amendment previously filed on ______________________ under 37 C.F.R. § 1.116 in the prior nonprovisional application.
2. ☒ A preliminary amendment is enclosed.
3. This application is filed by fewer than all the inventors named in the prior application, 37 C.F.R. § 1.53 (d)(4).
   a. ☐ ***DELETE*** the following inventor(s) named in the prior nonprovisional application:
   ....
   ....
   b. ☐ The inventor(s) to be deleted are set forth on a separate sheet attached hereto.
4. ☐ A new power of attorney or authorization of agent (PTO/SB/81) is enclosed.
5. Information Disclosure Statement (IDS) is enclosed:
   a. ☐ PTO-1449
   b. ☐ Copies of IDS Citations

RECEIVED 98 SEP -8 PM 1:46 GROUP 2700

08709487

[Page 1 of 2]

Burden Hour Statement: This form is estimated to take 0.4 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box CPA, Washington, DC 20231.

EXHIBIT B
PAGE 78

Please type a plus sign (+) ins... this box → [+]

PTO/SB/29 (1/96)
Approved for use through 09/30/2000. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
	TOTAL CLAIMS (37 C.F.R. § 1.16(c) or (j))	31 -20* =	11	x $ 22 =	$ 242.00
	INDEPENDENT CLAIMS (37 C.F.R. §1.16(b) or (i))	4 -3** =	1	x $ 82 =	$ 82.00
	MULTIPLE DEPENDENT CLAIMS (if applicable) (37 C.F.R. § 1.16(d))			+ $ 0 =	
				BASIC FEE (37 C.F.R. §1.16)	$ 790.00
			Total of above Calculations =		
	Reduction by 50% for filing by small entity (Note 37 C.F.R. §§ 1.9, 1.27 & 1.28).				
	* *Reissue claims in excess of 20 and over original patent.* ** *Reissue independent claims over original patent.*			TOTAL =	$ 1,114.00

6. Small entity status:
   a. ☐ A small entity statement is enclosed, if (b) and (c) do not apply.
   b. ☐ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
   c. ☐ is no longer claimed.
7. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 16-2195 :
   a. ☒ Fees required under 37 C.F.R. § 1.16.
   b. ☒ Fees required under 37 C.F.R. § 1.17.
   c. ☒ Fees required under 37 C.F.R. § 1.18.
8. ☒ A check in the amount of $ 1,114.00 is enclosed.
9. ☐ Other: ....

NOTE: ***The prior application's correspondence address will carry over to this CPA UNLESS a new correspondence address is provided below.***

10. NEW CORRESPONDENCE ADDRESS

☐ *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or ☐ *New correspondence address below*

Name					
Address					
City		*State*		*Zip Code*	
Country		*Telephone*		*Fax*	

11. SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Name (Print/Type)	Donald F. Mofford
Signature	Donald F. Mofford
Registration No. (Attorney/Agent)	33,740
Date	September 02, 1998

[Page 2 of 2]

EXHIBIT B
PAGE 79

OIPE SEP - 2 1998 JCS PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney's Docket No.: **8166**

Group Art Unit: 2721
Examiner: D. Mariam

Application of:	Bror O. Hultgren,III, et al.
Serial No.:	08/ 709,487
Filed:	September 06, 1996
For:	**DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM**

CERTIFICATE OF EXPRESS MAIL FILING

Cambridge, Massachusetts 02139
September 02, 1998

Honorable Assistant Commissioner for Patents
Box CPA
Washington, D.C. 20231

Dear Sir:

I hereby certify that a Continued Prosecution Application (CPA) Request Transmittal (Pages 1 and 2), Preliminary Amendment, Check No. 10238 in the amount of $ 1,114.00 for filing fee, Check No. 10238 and a post card is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service Mailing Label No.: **EE 226 611 827 US**, under 37 CFR 1.10 on the date indicated above and is addressed to Assistant Commissioner for Patents, Box CPA, Washington, D.C. 20231.

Respectfully submitted,

Donald F. Mofford
Registration No. 33,740

Polaroid Corporation
784 Memorial Drive
Cambridge, Massachusetts 02139
Tel: 781 386-6432
Fax: 781 386-6435

EE 226 611 827 US
#8
9-10-98
JB

OIPE SEP - 2 1998 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art No. 2721
Examiner Daniel G. Mariam

Preliminary Amendment

Bror O. Hultgren, III, et al.

Device Profiles For Use In A Digital Image Processing System

Serial No. 08/709,487

Filed: September 6, 1996

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GROUP 2700

Assistant Commissioner
of Patents
Washington, D. C. 20231

Dear Sir:

PRELIMINARY AMENDMENT

In response to the Office Action dated June 2, 1998, reconsideration and re-examination are hereby requested.

The Examiner rejected Claims 1, 9, 16 and 24 under 35 U.S.C. § 103(a) as being unpatentable over Winkelman (5,668,890) in view of Spiegel et al (5,615,282).

The Examiner also rejected Claims 2-8, 10-15,17-23 and 25-31 under 35 U.S.C. § 103(a) as being unpatentable over Winkelman in view of Spiegel et al as applied to claims 1, 9, 16, and 24 and further in view of Cottrell et al (5,694,484).

It is Applicants understanding Winkelman teaches transforming the image value (R,G,B) of the first color space into functionally appertaining image values (L*,a*,b*) of a second color space that is independent of the first color space, and analysis of the image original for calculating setting values for the image processing is implemented with reference to the transformed image values (L*,a*,b*) of the second color space. (Col. 2, lines 47-55)

Applicants teach characterizing a device profile for a digital device comprising first data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial information content of the image to said device independent color space. The latter provides both chromatic characteristic information and spatial characteristic information of a device thus enhancing the capability of a digital image processing system to render an exact duplicate of an image.

It is respectfully submitted that Claim 1 is patentable over Winkelman in view of Spiegel et al, since Winkelman in view of Spiegel et al neither describe nor suggest "... device profile comprising: first data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial information content of the image to said device independent color space".

Dependent Claim 2 adds the limitation "wherein, for said device, the second data is represented by a first characteristic function describing added noise characteristics and a second characteristic function describing image signal transform characteristics" to claim a further patentably distinct feature of the invention.

As Claims 3 through 8 depend from Claim 1 and cite additional structure, they too are allowable for analogous reasons.

It is respectfully submitted that Claim 9 is patentable over Winkelman in view of Spiegel et al, since Winkelman in view of Spiegel et al neither describe nor suggest the method of

"generating first data for describing a device dependent transformation of color information content of the image to a device independent color space in response to a color characteristic function describing added noise characteristics; generating second data for describing a device dependent transformation of spatial information content of the image to said device independent color space in response to a spatial characteristic function describing image signal transform characteristics; and combining said first and second data into the device profile."

As Claims 10 through 15 depend from Claim 9 and cite additional steps, they too are allowable for analogous reasons.

Independent Claim 16 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest the combination of "means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space in response to a color characteristic function describing added noise characteristics; and means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image to said device independent color space signal transform characteristics."

As Claims 17 through 23 depend from Claim 16 and cite additional structure, they too are allowable for analogous reasons.

Claim 24 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest a "device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an

image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space."

As Claims 25 through 31 depend from Claim 24 and cite additional structure, they too are allowable for analogous reasons.

Accordingly, re-examination and reconsideration are requested in view of the above amendment and remarks.

Respectfully submitted,

Donald F. Mofford
Registration No. 33,740
Attorney for the Applicant(s)

Polaroid Corporation
784 Memorial Drive
Cambridge, MA 02139
(781) 386-6432
September 2, 1998
Case No. 8166
DFM/pc

8M

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, DC 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN	B	8166(RAS)

LM02/1007

POLAROID CORPORATION
PATENT DEPARTMENT
549 TECHNOLOGY SQUARE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM,D	
ART UNIT	**PAPER NUMBER**
2721	9

DATE MAILED: 10/07/98

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (REV. 2/95)

1-File Copy

☆U.S.GOVERNMENT PRINTING OFFICE 1995-319-826

EXHIBIT B
PAGE 85

Office Action Summary	Application No. 08/709,487	Applicant(s) Hultgren, III, et al
	Examiner Daniel G. Mariam	Group Art Unit 2721

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Response

A SHORTENED STATUTORY PERIOD FOR RESPONSE IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a response be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for response is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to respond within the set or extended period for response will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 9-2-98.

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-31 is/are pending in the application.

Of the above claim(s) ___ is/are withdrawn from consideration.

☐ Claim(s) ___ is/are allowed.

☒ Claim(s) 1-31 is/are rejected.

☐ Claim(s) ___ is/are objected to.

☐ Claim(s) ___ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on ___ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on ___ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) ___.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received: ___.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ___

☒ Notice of References Cited, PTO-892

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Interview Summary, PTO-413

☐ Notice of Informal Patent Application, PTO-152

☐ Other ___

Office Action Summary

U. S. Patent and Trademark Office
PTO-326 (Rev. 3-97) *U.S. GPO: 1997-417-381/62710 Part of Paper No. 9

EXHIBIT B
PAGE 86

Continued Prosecution Application

1. The request filed on September 2, 1998, for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 08/709,487 is acceptable and a CPA has been established. An action on the CPA follows.

Response to Arguments

2. Applicant's preliminary amendment filed September 2, 1998, have been fully considered but they are not deemed to be persuasive for at least the following reasons.

Applicant generally argues, that neither Winkelman nor Spiegel, et discloses the limitations as recited in claims 1-31. Applicant points out, that . . . second data for describing for a device dependent transformation of spatial information content of the image to said device independent color space. The latter provides both chromatic characteristic information and spatial characteristic information of a device thus enhancing the capability of a digital image processing system to render an exact duplicate of an image.

Applicant's point is well taken. However, Spiegel, et al clearly teaches this feature (see the abstract, for example). More over, Winkelman teaches, at col. 6, lines 6-14, that the color values R, G, B of the device-specific RGB color space 14 of the input devices 1, 2, 3 are mathematically transformed into the reference color system 13 by suitable input calibration. The

color values X, Y, Z of the reference color system 13 are transformed by mathematically defined transformations into color values of a selectable, device-independent communication color space 15 with which the master analysis (i.e., frequency distribution for example) and the image processing can be carried out . The details of master analysis is described with respect to Fig. 3. Therefore, the combined teaching of Winkelman and Spiegel clearly meets Applicant's claimed invention.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

4. Claims 1 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Laumeyer, et al (5,572,632).

With regard to claim 1, Laumeyer, et al (hereinafter "Laumeyer") discloses first data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial information (i.e., size, resolution, spatial locations, etc....) of the image to the device independent color space (col. 8, line 4 - col. 10, line 17).

With regard to claim 24, as best understood, claim 1 encompasses the limitation of this claim and thus it is met by the prior art.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman (5,668,890) in view of Spiegel, et al (5,615,282).

With regard to claim 1, Winkelman discloses a method and an apparatus for electronic reproduction of images comprising:

First data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of (minus-spatial information content) of the image to the device independent color space (col. 2, lines 46-55; col. 4, line 66 - col. 5, line 6; col. 6, lines 10-14). Winkelman does not explicitly call for a device dependent transformation operation using a spatial information content of the image. However, this feature is taught by Spiegel (col. 33, line 44 - col. 34, line 8; col. 34, lines 5-9). Also, Applicant's attention is invited to paragraph 2 above.

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Spiegel, et al into Winkelman's system in order to transform the spatial characteristic of the color image.

Claim 9 is rejected the same as claim 1. Thus, argument analogous to that presented above for claim 1 is applicable to claim 9. The limitation "added noise" is considered inherent in Spiegel et al system, because modifying the spatial and color characteristics of the digital image clearly involves a noise as modifying process is carried out in response to the characteristics of the images, to preserve the color of the original image (col. 9, lines 11-31; abstract; col. 5, lines 29-49; , for example). As to combining the first and second data into the device profile (see Figure 2, ##, 16 and 17).

Claim 16 is rejected the same as claims 1 and 9 except claim 16 is an apparatus claim. Thus, arguments analogous to those presented above for claims 1 and 9 are applicable to claim 16.

Claim 24 is rejected the same as claim 1. Thus, argument similar to that presented above for claim 1 is applicable to claim 24.

7. Claims 2-8, 10-15, 17-23 and 25-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman in view of Spiegel, et al as applied to claims 1, 9, 16, and 24 above, and further in view of Cottrell, et al (5,694,484).

With regard to claim 2, Winkelman (as modified by Spiegel, et al) discloses all the claimed subject matter except explicitly calling for a first characteristic function describing added noise characteristics. However, this is taught by Cottrell, et al (abstract; column 18, lines 3-52).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Cottrell et al into Winkelman's (as modified by Spiegel, et al) system if no other reason than to have a function describing an additive noise characteristics.

Claims 3, 7, and 8 are rejected the same as claims 1 and 2. Thus, arguments similar to those presented above for claims 1 and 2 are applicable to claims 3, 7, and 8.

With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. (5,257,097) to Pineau, et al discloses method and apparatus for selective interception of a graphics rendering operation for effecting image data modification; US Patent No. (5,450,216) to Kasson discloses color image gamut-mapping system with chroma enhancement at human-insensitive spatial frequencies; and a publication to Murch discloses "New Paradigms for Visualization".

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

September 30, 1998

BIPIN SHALWALA
PATENT EXAMINER
GROUP 2600

Notice of References Cited	Application No. 08/709,487	Applicant(s) HULTGREN, III, et al
	Examiner Daniel G. Mariam	Group Art Unit 2721 — Page 1 of 1

U.S. PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
	A	5,257,097	10-26-93	Pineau, et al	358	527
	B	5,450,216	9-12-95	Kasson	358	~~518~~
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
	N						
	O						
	P						
	Q						
	R						
	S						
	T						

NON-PATENT DOCUMENTS

*		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
	U	Murch "New Paradigms for Visualization," IEEE, pp. 550-551	1990
	V		
	W		
	X		

* A copy of this reference is not being furnished with this Office action.
(See Manual of Patent Examining Procedure, Section 707.05(a).)

U.S. Patent and Trademark Office
PTO-892 (Rev. 9-95)

Part of Paper No. 9

*U.S. GPO: 1997-417-381/62700

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

#10

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LOCATION 27C1 SERIAL NUMBER 08709487 PATENT NUMBER

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THE PRACTITIONERS OF RECORD HAVE BEEN CHANGED TO CUSTOMER # 20349

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ON 11/27/98 THE ADDRESS OF RECORD FOR CUSTOMER NUMBER 20349 IS:

POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

AND THE PRACTITIONERS OF RECORD FOR CUSTOMER NUMBER 20349 ARE:

24359	24359	25173	25173	25778	25778	25937	25937	26378	26378
29629	29629	33740	34442	34442	35344	36780	36780	40049	40256
42562	42562								

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PTO-FMD
TALBOT-1/97

SENT BY:POLAROID : 2- 8-99 ; 17:32 ; 6173866435→ 7033085397;# 6

#11
2-10-99
MJC

IN THE UNITED STATES PATENT AND RADEMARK OFFICE

Group Art Unit 2721
Examiner Daniel G. Mariam

Petition for Extension of Time

Bror O. Hultgren, III, et al.
Device Profiles For Use In A Digital Image Processing System
Serial No. 08/709,487
Filed: September 6, 1996

OFFICIAL

Certification of Facsimile Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office on the date shown below to Tel. No. (703) 308-5397.
February 8, 1999

Name Donald F. Mofford Reg. No. 33,740
Signature
Date February 8, 1999

FAX RECEIVED
FEB 9 1999
Group 2700

Assistant Commissioner of Patents
Washington, DC 20231

Sir:

PETITION FOR AN EXTENSION OF TIME UNDER 37 CFR 1.17(a)

Applicants hereby petition for an extension of time under 37 CFR 1.17(a) to extend the 3 month statutory period one (1) month to February 7, 1999 for the response to the Office Action dated October 7, 1998, which was due on January 7, 1999.

Authorization is hereby given to charge the amount of $110.00 and to charge any excess fees or credit any overpayment to Polaroid Deposit Account No. 16-2195.

Respectfully Submitted,

Donald F. Mofford
Registration No. 33,740
Attorney for the Applicants

Polaroid Corporation
Cambridge MA 02139
(781) 386-6432
February 8, 1999
Case No. 8166

02/10/1999 MCOLEMAN 00000002 162195 08709487
01 FC:115 110.00 CH

SENT BY:POLAROID 2- 8-88 ; 17:31 ; 8173868435→ 7033085397;# 1 #12

2-10-99

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FEB 9 1999

Group 2700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art No. 2721
Examiner Daniel G. Mariam

Amendment

Bror O. Hultgren, III, et al.

Device Profiles For Use In A Digital Image Processing System

Serial No. 08/709,487

Filed: September 6, 1996

Assistant Commissioner
of Patents
Washington, D. C. 20231

Post-it® Fax Note 7871	Date 2-8-99 # of pages ▸ 6
To Examiner Mariam	From Don Mofford
Co./Dept.	Co.
Phone #	Phone #
Fax # 703-308-5397	Fax #

Certification of Facsimile Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office on the date shown below to Tel. No. (703) 308-5397.
February 8, 1999

Name Donald F. Mofford Reg. No. 33,740

Signature

Date February 8, 1999

Dear Sir:

AMENDMENT

In response to the Office Action dated October 7, 1998, reconsideration and re-examination are hereby requested.

The Examiner rejected Claims 1 and 24 under 35 U.S.C. § 102(e) as being anticipated by Laumeyer et al. (5,572,632).

The Examiner also rejected Claims 1, 9, 16 and 24 under 35 U.S.C. § 103(a) as being unpatentable over Winkelman (5,668,890) in view of Spiegel et al (5,615,282).

The Examiner also rejected Claims 2-8, 10-15,17-23 and 25-31 under 35 U.S.C. § 103(a) as being unpatentable over Winkelman in view of Spiegel et al as applied to claims 1, 9, 16, and 24 and further in view of Cottrell et al (5,694,484).

It is Applicants belief that Applicant is the first to provide a device profile comprising data for describing spatial information of a device in the profile in device independent space. It is recognized that color and space information for device dependent space has been utilized, but not spatial information for device independent color space.

The Examiner suggests that Laumeyer teaches a device profile. Applicants respectfully submit that Laumeyer teaches a process and neither describes not suggests creating a device profile. Thus claims 1 and 24 are not anticipated by Laumeyer et al., since Laumeyer does not teach a device profile.

The Examiner suggests that Winkelman in view of Spiegel et al teaches the invention claimed in Claims 1, 9, 16 and 24. Applicants respectfully submit that Winkelman teaches color information transformation, but not spatial information transformation as also recognized by the Examiner. The Examiner suggests that this feature is taught by Spiegel. Applicants respectfully submit that Applicants claim a "device profile comprising ... second data for describing a device dependent transformation of spatial information content of the image to said device independent color space" a feature not suggested by Spiegle. Again Spiegle is teaching a process, not a device profile with the above claimed feature.

Applicants teach characterizing a device profile for a digital device comprising first data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial information content of the image to said device independent color space. The latter provides both chromatic characteristic information and spatial characteristic information of a device thus enhancing the capability of a digital image processing system to render an exact duplicate of an image.

It is respectfully submitted that Claim 1 is patentable over Laumeyer et al or Winkelman in view of Spiegel et al, since Laumeyer et al or Winkelman in view of Spiegel et al neither describe nor suggest "... device profile comprising: ... second data for describing a device dependent transformation of spatial information content of the image to said device independent color space".

As Claims 2 through 8 depend from Claim 1 and cite additional structure, they too are allowable for analogous reasons and for reasons previously stated

It is respectfully submitted that Claim 9 is patentable over Laumeyer et al or Winkelman in view of Spiegel et al, since Laumeyer et al or Winkelman in view of Spiegel et al neither describe nor suggest the method of generating a device profile comprising " ... generating second data for describing a device dependent transformation of spatial information content of the image to said device independent color space in response to a spatial characteristic function describing image signal transform characteristics; and combining said first and second data into the device profile."

As Claims 10 through 15 depend from Claim 9 and cite additional steps, they too are

allowable for analogous reasons.

Independent Claim 16 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in response to a spatial characteristic function describing image to said device independent color space signal transform characteristics."

As Claims 17 through 23 depend from Claim 16 and cite additional structure, they too are allowable for analogous reasons.

Claim 24 is neither described nor suggested by the references since the references taken separately or in combination neither describe nor suggest a "device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space."

As Claims 25 through 31 depend from Claim 24 and cite additional structure, they too are allowable for analogous reasons.

Applicants have submitted herewith a Petition for an Extension of Time for one month with authorization to charge Polaroid Corporation Deposit Account No. 16-2195 the fee of $110.00 and for any excess fees due or credit any overpayment.

Accordingly, re-examination and reconsideration are requested in view of the above amendment and remarks.

Respectfully submitted,

Donald F. Mofford
Registration No. 33,740
Attorney for the Applicant(s)

Polaroid Corporation
784 Memorial Drive
Cambridge, MA 02139
(781) 386-6432
February 8, 1999
Case No. 8166
DFM/pc

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN	B	8166(RAS)

020349 LM01/0414
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM,D	
ART UNIT	PAPER NUMBER
2721	13

DATE MAILED: 04/14/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95) 1- File Copy

Office Action Summary	Application No. 08/709,487	Applicant(s) Hultgren III, et al
	Examiner Daniel G. Mariam	Group Art Unit 2721

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 2-8-99.

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-31 is/are pending in the application.

Of the above claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) 1-31 is/are rejected.

☐ Claim(s) ______ is/are objected to.

☐ Claim(s) ______ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on ______ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received: ______.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☒ Notice of Reference(s) Cited, PTO-892

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Interview Summary, PTO-413

☐ Notice of Informal Patent Application, PTO-152

☐ Other ______

Office Action Summary

U. S. Patent and Trademark Office
PTO-326 (Rev. 9-97)

*U.S. GPO: 1997-433-221/62717

Part of Paper No. 13

Response to Amendment

1. Applicant's arguments with respect to claims 1-31 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stokes (5,881,209) in view of Stokes (hereinafter "ST2) (5,634,092).

With regard to claim 1, Stokes discloses a method and system for automatically generating printer profiles comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space ; and second data for describing a device dependent transformation of spatial information of the image to the device independent color space (col. 5, lines 18-23).

Stokes further teaches a color utility which can include a set of routines and data structures that enable color processing system 26 to match colors and communicate color information between the various source and destination devices. . . . . Color information described in a color profile includes data relating to the device's color space, gamut, tonal reproduction curves, and the preferred color matching method model (col. 4, lines 34-44).

Stokes does not explicitly disclose spatial information content of the image. However, this feature is taught by ST2 (col. 2, lines 4-13; col. 6, lines 47-53).

Stokes and ST2 are combinable because they are from a similar problem solving area, i.e., transferring image data from one device to another, in accordance with the respective color profile of the two devices (col. 3, lines 47-50, for example). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of ST2 with Stokes. The motivation for doing so is to provide spatial content of the image and to allow more efficient processing, and lower input/output processing (col 2, lines 2-65; col. 6, lines 51-53 of ST2). Therefore, it would have been obvious to combine ST2 with Stokes to obtain the invention as specified in claim 1.

With regard to claim 24, as best understood, claim 1 encompasses the limitation of this claim and thus it is met by the prior art.

4. Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman (5,668,890) in view of Ohtsuka, et al (5,606,432).

With regard to claim 1, Winkelman discloses a method and an apparatus for electronic reproduction of images comprising:

First data for describing a device dependent transformation of color information content of the image to a device independent color space; and second data for describing a device dependent transformation of spatial information content of the image to the device independent color space (col. 2, lines 46-55; col. 4, line 66 - col. 5, line 6; col. 6, lines 10-14). Winkelman does not explicitly call for a device dependent transformation operation using a spatial information content of the image. However, this feature, i.e., resolution, noise, for example, is taught by Ohtsuka, et al (col. 1, line 41 - col. 2, line 37; col. 5, lines 27-60).

Winkelman and Ohtsuka, et al are combinable because they are from a similar problem solving area, i.e., generating device profile (#18, Fig. 1). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Ohtsuka, et al with Winkelman. The motivation for doing so is to provide a color image reproducing system which is capable of reproducing a simulated image on a monitor device whose appearance agrees highly accurately with an image on a printed material by taking into account periodic noise or random noise introduced in the printed image (col. 2, lines 2-7 of Ohtsuka, et al). Therefore, it would have been obvious to combine Ohtsuka, et al with Winkelman to obtain the invention as specified in claim 1.

Claim 9 is rejected the same as claim 1. Thus, argument analogous to that presented above for claim 1 is applicable to claim 9. As to describing an added noise characteristics, this

feature is clearly taught by Ohtsuka, et al (col. 13, lines 14-51). Also, as to combining the first and second data into the device profile (see Figure 2, ##, 16 and 17 of Winkelman).

Claim 16 is rejected the same as claims 1 and 9 except claim 16 is an apparatus claim. Thus, arguments analogous to those presented above for claims 1 and 9 are applicable to claim 16.

Claim 24 is rejected the same as claim 1. Thus, argument similar to that presented above for claim 1 is applicable to claim 24.

5. Claims 2-8, 10-15, 17-23 and 25-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winkelman in view of Ohtsuka, et al applied to claims 1, 9, 16, and 24 above, and further in view of Cottrell, et al (5,694,484).

With regard to claim 2, Winkelman (as modified by Ohtsuka, et al) discloses all the claimed subject matter except explicitly calling for a first characteristic function describing added noise characteristics. However, this is taught by Cottrell, et al (abstract; column 18, lines 3-52).

Therefore, it would have been obvious to one having ordinary skill in the art to incorporate the teaching as taught by Cottrell et al into Winkelman's (as modified by Ohtsuka, et al) system if for no other reason than to have a function describing an additive noise characteristics.

Claims 3, 7, and 8 are rejected the same as claims 1 and 2. Thus, arguments similar to those presented above for claims 1 and 2 are applicable to claims 3, 7, and 8.

With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. (5,646,752) to Kohler, et al discloses color image processing apparatus which uses private tags to alter a predefined color transformation sequence of a device profile; US Patent No. (5,838,333) to Matsuo discloses image processing device and image processing method.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

April 11, 1999

Phuoc Tran

PHUOC TRAN
PRIMARY EXAMINER

02/07/00 10:52 FAX 781 386 6435 POLAROID PATENT DEPT. 003

04/23/99 FRI 13:57 FAX 703 3... USPTO WORKGROUP 2720 002

Notice of References Cited	Application No. 09/709,497	Applicant(s) Hultgren III, et al	
	Examiner Daniel G. Mariam	Group Art Unit 2721	Page 1 of 1

U.S. PATENT DOCUMENTS

	DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
A	5,606,432	2-25-97	Ohtsuka, et al	358	527
B	5,634,092	5-27-97	Stokes	345	419
C	5,646,752	7-8-97	Kohler, et al	358	520
D	5,838,333	11-17-98	Matsuo	345	431
E	5,881,209	3-9-99	Stokes	358	504
F					
G					
H					
I					
J					
K					
L					
M					

FOREIGN PATENT DOCUMENTS

	DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
N						
O						
P						
Q						
R						
S						
T						

NON-PATENT DOCUMENTS

	DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
U		
V		
W		
X		

U. S. Patent and Trademark Office
PTO-892 (Rev. 9-95)

Notice of References Cited

Part of Paper No. 13

Docket No. C-8166/RJD

OIPE JC78 JUL 19 1999 PATENT & TRADEMARK OFFICE

PATENT

#14/C
KD
7-27-99

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.: 08/709,487
Filed: September 6, 1996
By: Hultgren et al.
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Art Unit: 2721
Examiner: D. Mariam

Assistant Commissioner for Patents
Washington, D.C. 20231

CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to Assistant Commissioner for Patents, Washington, D.C. 20231.

Date: July 14, 1999

Robert J. Decker
Registration No. 44,056

RECEIVED
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AMENDMENT UNDER 37 C.F.R § 1.115

Sir:

In response to the Office Action dated April 14, 1999, having a three (3) month shortened statutory period set to expire July 14, 1999, please amend the above captioned application as follows:

IN THE SPECIFICATION:

Page 3, line 8: after "both" insert --the measured--;

line 8: after "chromatic" insert --response--; and

line 8: replace "characteristic functions" with --stimuli and device response--.

L lines 9-10: replace "characteristics of a processed image" with --characteristic

C1 functions of an imaging element or device--.

Page 8, line 4: replace existing equation " M'(u,v) = K(u,v) * M(u,v) " with the equation as follows -- M"(u,v) = K_i(u,v) * M(u,v) --; and

07/20/1999 AIBRAHIM 00000108 08709487

01 FC:103 36.00 OP

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18

Serial No. 08/709,487
Docket No. C-8166/RJD

line 5: replace existing equation " $N''(u,v) = K^2(u,v) * N(u,v) + N(u,v)$ " with the equation as follows -- $N''(u,v) = K_i^2(u,v) * N(u,v) + N_i(u,v)$ --.

IN THE CLAIMS:

Please amend claims 1, 9, 10, 11, 12, 14, 16, and 24 as follows:

Sub D1

C2

1. (TWICE AMENDED) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

second data for describing [a] device dependent [transformation of] coordinate spatial information content of the image [to] in said device independent color space.

Sub D2

C3

9. (TWICE AMENDED) A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space [in response to a color] through use of measured chromatic stimuli and device response characteristic [function describing added noise characteristics] functions;

generating second data for describing [a] device dependent [transformation of] spatial information content of the image [to] in said device independent color space through use of [in response to a] spatial stimuli and device response characteristic [function describing image signal transform characteristics] functions; and

combining said first and second data into the device profile.

C4

~~10~~ 12. (AMENDED) The method of claim [9] ~~33~~ 11 wherein, for said device, said added noise characteristics are represented by a Wiener Noise Spectrum and said image signal transform characteristics are represented by a Modulation Transfer Function.

19

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C4

13 ~~11~~. (AMENDED) The method of claim [9] ~~33~~ 11 wherein the second data is represented by characteristic functions describing a gray level dependent additive noise in said device.

Con'd

14 ~~12~~. (AMENDED) The method of claim [9] ~~33~~, 11 wherein said gray level dependent additive noise is represented by Wiener Noise Spectra.

C5

16 ~~14~~. (AMENDED) The method of claim [9] ~~35~~, 11 wherein the second data is represented by characteristic functions describing spatially dependent additive noise in said device.

S33

C6

16. (TWICE AMENDED) A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space [in response to a color] through use of chromatic response characteristic [function] functions; and

means for utilizing second data of the device profile for describing [a] device dependent [transformation of] spatial information content of the image in said device independent color space [in response to a] through the use of spatial characteristic [function describing image to said device independent color space signal transform characteristics] functions describing image spatial transform characteristics in said device independent color space.

S34

C7

24. (TWICE AMENDED) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing [a] device dependent [transformation of] spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

Please add the new claims 32 and 33 as follows.

C8

9 ~~32~~. (NEW) The device profile of claim 1 wherein, for said device, the second data is generated through use of spatial stimuli and device response characteristic functions.

20

Serial No. 08/709,487
Docket No. C-8166/RJD

33. (NEW) The method of claim 9 wherein, for said device:

the first data is represented by a color characteristic function describing added noise characteristics; and

the second data is represented by a spatial characteristic function describing image signal transform characteristics.

IN THE ABSTRACT:

Page 14, lines 2-12: replace the existing Abstract with the paragraph as follows.

-- Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both the measured chromatic response and spatial stimuli and device response functions within a model based image processing system to predict both color and spatial characteristic functions on an imaging element or device. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.--

REMARKS

I. STATUS OF THE CLAIMS

Claims 1-33 are pending in the application.

Claims 1, 9, 16, and 24 are independent claims.

Claims 1-31 stand rejected under 35 U.S.C. § 103.

New dependent claims 32 and 33 have been added.

II. AMENDMENTS

The specification and the abstract has been amended to correct obvious informalities and to clarify the invention.

New claim 32 further clarifies the invention and new claim 33 is similar to original claim 2.

It is believed that the amendments do not involve the addition of any new matter.

III. IN THE DRAWINGS

To correct obvious informalities and to clarify the invention, Applicants have revised Fig. 4, as illustrated by the "redline" drawings enclosed herewith, so as to be consistent with revised equation nos. 8 and 9 of page 8 of the specification.

Applicants respectfully request approval of the proposed corrections.

The revisions to the drawings are believed to add no new matter.

IV. AMENDED CLAIMS 1 AND 24 ARE PATENTABLE UNDER 35 U.S.C. § 103 OVER STOKES 5,881,209 IN VIEW OF STOKES 5,634,092 BECAUSE THE APPLIED PRIOR ART TAKEN AS A WHOLE FAILS TO SUGGEST THE APPLICANTS' INVENTION

Claims 1 and 24 are rejected under 35 U.S.C. § 103 as being unpatentable over Stokes U.S. Patent 5,881,209 (hereinafter "Stokes") in view of Stokes U.S. Patent 5,634,092 (hereinafter "ST2").

Applicants respectfully submit that claims 1 and 24 would not have been obvious under 35 U.S.C. § 103 over Stokes in view of ST2 because the applied prior art fails to teach or suggest the device profile intended for a image reproduction system for capturing, transforming, or rendering an image as recited in base claims 1 and 24, respectively, which calls for:

> ...second data for describing <u>device dependent spatial information content of the image in said device independent color space</u>.
>
> ...said device profile comprising data for describing <u>device dependent spatial information content of the image in a device independent color space</u>, wherein through use of spatial stimuli and device response for said device, said data is represented by characteristic functions.

The Examiner suggests that the primary reference Stokes discloses color information described in a color profile including data relating the device's color space, but does not teach the spatial information content of the image.

Next, with regards to the secondary reference ST2, ST2 discloses processing algorithms that are being called which can be either color or spatial. ST2 provides:

> a single interface, or bottleneck, which obviates the need to bundle specific types of functionality with individual application programs. This approach allows for distributed processing, more efficient processing, and lower input/output requirements.

(col. 6, lines 47-53). However, it is known in the art that many complex imaging processing programs will follow some type of application process interface (API). The ST2 API includes an architecture that calls both color matching algorithms which operate on a point-wise basis and spatial algorithms which operate on a neighborhood basis. Generally, point-wise operations involve reading pixels or screening pixels and these point operations are read one pixel at a time. Whereas, with neighborhood operations, the image needs to be read in by some pixel band or pixel strip because it requires a group of pixels to be resident in memory at one point in time, so that one pixel is processed with reference to its neighboring pixels. The architecture needs to be flexible to accomplish both.

The ST2 API provides flexible enough architecture to support both spatial algorithms and color algorithms. ST2 API essentially initiates (i.e., runs, launches , or enables) the various algorithms. For example, depending on the set of instructions that is provided to the API, e.g., desired coloring, sharpening, noise-reduction, or compression, the API will manage the color or spatial algorithms. Or stated differently:

> As a result, the user is not forced to process the image with one application to obtain one result, e.g. unsharp masking, and then use a different program to obtain yet another service, such as image compression. Rather, the user is provided with a single coherent interface through which all available image processing services can be accessed.

(col. 5, lines 9-15).

In contrast, the present invention provides the actual data which the spatial algorithm requires for processing. The present invention pertains to the required information that is

actually being supplied to the spatial algorithm, i.e., the present invention provides a means for providing the data. Whereas ST2 is providing a means for turning a given Algorithm on or off, i.e., launching or enabling a given algorithm. For example, in order to run a color matching algorithm, it requires a data structure. Thus, one of the distinguishing features of the present invention (compared to ST2) is that the present invention actually provides the data required for the operation. The present invention's device profile is generated by use of both the measured chromatic and spatial stimuli and device response within a model based image processing system to predict both color and spatial characteristic functions of an imaging element or device.

In summary, the Examiner's reliance on ST2's multiple image processing operations through a single interface does not supply the deficiencies of the Stokes disclosure vis-à-vis Applicants' base claims 1 and 24. Accordingly, neither ST2, nor Stokes taken alone, or in combination, would have suggested Applicants' invention of base claims 1 and 24. Claims 2-8, 32, and 25-31 are dependent from claims 1 and 24, respectively, and include all the limitations of the latter claims. A dependent claim contains all the limitations of the independent claim upon which it depends and is non-obvious under Federal Circuit guidelines if the independent claim upon which it depends is allowable.

Hence, it is Applicants' position that the cited art as a whole fails to teach or suggest the claimed invention within the meaning of 35 U.S.C. § 103 and request that the rejection of claims 1-8, and 24-32 be withdrawn.

V. AMENDED CLAIMS 1, 9, 16, AND 24 ARE PATENTABLE UNDER 35 U.S.C. § 103 OVER WINKELMAN IN VIEW OF OHTSUKA ET AL.; AND CLAIMS 2-8, 10-15, 17-23, AND 25-33 ARE PATENTABLE OVER WINKELMAN AND OHTSUKA ET AL. FURTHER IN VIEW OF COTTRELL ET AL. BECAUSE THE APPLIED PRIOR ART TAKEN AS A WHOLE FAILS TO SUGGEST THE APPLICANTS' INVENTION

Base claims 1, 9, 16, and 24 are rejected under 35 U.S.C. § 103 as being unpatentable over Winkelman U.S. Patent 5,668,890 in view of Ohtsuka et al. U.S. Patent 5,606,432 ("Ohtsuka"); as well as claims 2-8, 10-15, 17-23, and 25-31 over Winkelman and Ohtsuka further in view of Cottrell et al. U.S. Patent 5,694,484 ("Cottrell").

Applicants respectfully submit that base claims 1, 9, 16, and 24 would not have been obvious under 35 U.S.C. § 103 over Winkelman in view of Ohtsuka because the applied prior art fails to teach or suggest the following of the present invention:

a) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 1 which calls for:

> ...second data for describing device dependent spatial information content of the image in said device independent color space.

b) a method intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 9 which calls for:

> ...generating second data for describing device dependent spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions;

c) an image processing system for capturing, transforming, or rendering an image, as recited in amended base claim 16 which calls for:

> ...means for utilizing second data of the device profile for describing device dependent spatial information content of the image in said device independent color space through the use of spatial characteristic functions describing image spatial transform characteristics in said device independent color space.

d) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 24 which calls for:

> ...said device profile comprising data for describing device dependent spatial information content of the image in a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by characteristic functions.

The Examiner suggests that primary reference Winkelman discloses transformation color information content of the image, but does not teach the operation using a spatial information content of the image.

Next, with regards to the secondary reference Ohtsuka, Ohtsuka discloses a system of providing data which enables an algorithm to add noise, i.e., a noise generating algorithm, in a manner that is appropriate to what the system determines the output image is going to look like.

Serial No. 08/709,487
Docket No. C-8166/RJD

For introduction purposes, it is noted that the goals of the present invention is quite different than the goal of Ohtsuka's invention, whereby the goal of Ohtsuka's invention is as follows: to enable the simulation of the appearance of a printed image (from a printing press) on another medium (i.e., "proofing" in the jargon of the industry). If the simulation is carried out to a CRT it is a "soft proof." If it is carried out on another type of printer, e.g., thermal printer or inkjet, it is called a "hard proof." Proofs have often been criticized because, while they may give the correct color impression, they fail to give the correct noise impression of the image being proofed as it will appear off the printing press. Therefore, Ohtsuka sought to include a simulation of those noise effects in his proofing image processing.

Whereas, one on the goals of the present invention is to codify the image information necessary to allow automatic image processing and quality optimization in an open system environment including input devices such as scanners, cameras, and computers; display devices like CRTs; output devices such as digital printers and film recorders; and even imaging processing operations such as sharpening, resizing, compressing, etc..

To enable the Ohtsuka simulation, Ohtsuka developed something referred to as a "profile" which organized and stored those characteristic noise features of the printing press being simulated. On the other hand with regards to the present invention, to enable optimization, the Applicants developed something referred to as a "profile" which contains an abstract description of the spatial response properties of any device in question (i.e., input device, display device, or output device; noise response and sharpness response).

However, the information Ohtsuka requires is necessarily very low level and tied to the specific properties of the printing press being simulated (e.g., screen ruling, dot shape, ink formulation, etc of Fig. 4 of Ohtsuka.). These properties do not at all apply to input devices or image processing operations.

As such, in the context of Fig. 7 of Ohtsuka:

> The color image data thus obtained are then outputted as a hard copy or displayed on the CRT by the image output unit 14A in a step S13. The operator confirms the outputted/displayed simulated color image in a step S14. If the operator sees no problem with respect to colors, etc., then the operator operates the image output unit 14B to produce a printed material in a step S15. If there is a problem, then the color image data are processed again in the image editor 12, printing conditions are modified, if necessary, and produced YMCK halftone dot percentage data are monitored repeatedly in the step S14.

(col. 13, lines 34-44).

In contrast, to be general enough for all devices and image processing operations, the present invention requires noise and sharpness descriptions that are not tied to any particular technology. The value of such general requirements of the present invention is neither disclosed nor suggested by Ohtsuka, or the applied prior art. The value of the present invention's general requirements derives from the automation made possible by placing all devices and image processing operations on a common basis so that image content can be modeled and image quality can be calculated and optimized.

In contrast, the present invention ties the profiles to the device and generates the profile by the process of the spatial stimuli and response functions within a model based image processing system to predict the spatial characteristic functions. The present invention characterizes any device or imaging element (whereas Ohtsuka describes the data), thus enabling spatial image processing in an open system.

In summary, the Examiner's reliance on Ohtsuka's image reproduction system does not supply the deficiencies of the Winkelman disclosure vis-à-vis Applicants' base claims 1, 9, 16, and 24. Accordingly, neither Ohtsuka, nor Winkelman taken alone, or in combination, would have suggested Applicants' invention of base claims 1, 9, 16, and 24. Claims 2-8, 32, 10-15, 33, 17-23, and 25-31 are dependent from claims 1, 9, 16, and 24, respectively, and include all the limitations of the latter claims. A dependent claim contains all the limitations of the independent claim upon which it depends and is non-obvious under Federal Circuit guidelines if the independent claim upon which it depends is allowable.

VI. CONCLUSION

Please charge any excess fees due and credit any overpayment to Charge Account No. 16-2195.

It should be noted that the above arguments are directed towards certain distinctions between the claims and the prior art cited which the Applicants believe make the pending claims patentable. However, the differences between the pending claims and the prior art cited is not necessarily limited to those distinctions.

For the foregoing reasons, Applicants respectfully submit that amended claims 1-31, and new claims 32 and 33, are in condition for allowance, and a notice for allowance is solicited.

Respectfully submitted,

RJ Decker 7/14/99

Tel: 781-386-6474
Fax: 781-386-6435

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

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Serial : 08/709,487
Attorney : C 8166

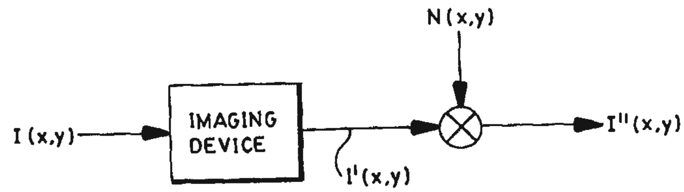

FIG. 3

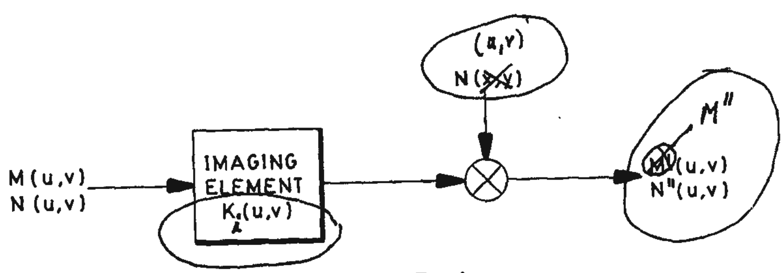

FIG. 4

GP 2721

Docket No. C-8166/RJD

PATENT

OIPE JC78 JUL 19 1999 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.: 08/709,487
Filed: September 6, 1996
By: Hultgren et al.
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Art Unit: 2721
Examiner: D. Mariam

CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to Assistant Commissioner for Patents, Washington, D.C. 20231.

Date: July 14, 1999

Robert J. Decker
Registration No. 44,056

RECEIVED JUL 23 1999 TECH CENTER 2700

Assistant Commissioner for Patents
Washington, D.C. 20231

FEE CALCULATION FOR ADDITIONAL CLAIMS

Sir:

Transmitted herewith is an amendment in the above-identified application. The fee has been calculated as shown below.

CLAIMS AS AMENDED

	Claims Remaining After Amendment		Highest Number Previously Paid For	Present Extra	Rate	Additional Fee
Total Claims	33	Minus	31	2	× 18.00	36.00
Independent Claims	4	Minus	4	0	× 78.00	0
Total additional fee for this amendment						36.00

Check No. 10590 in the amount of $36.00 is attached. Please charge any additional fee due, or credit any excess fee paid to deposit account number 16-2195. A duplicate copy of this paper is enclosed.

Respectfully submitted,

7/14/99

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

Tel: 781-386-6474
Fax: 781-386-6435

G:\Patent\Cases\8166 RJD\8166AddClaimsFee.DOC

UNITED STAT. DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

J.N

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN	B	8166(RAS)

020349
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

LM31/0924

EXAMINER	
MARIAM,D	
ART UNIT	**PAPER NUMBER**
2721	15

DATE MAILED: 09/24/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)

1- File Copy

Office Action Summary	Application No. 08/709,487	Applicant(s) Hultgren, III, et al
	Examiner Daniel G. Mariam	Group Art Unit 2721

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 7-19-99.

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-33 is/are pending in the application.

Of the above claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) 1-33 is/are rejected.

☐ Claim(s) ______ is/are objected to.

☐ Claim(s) ______ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on ______ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other ______

Office Action Summary

U. S. Patent and Trademark Office
PTO-326 (Rev. 9-97)

*U.S. GPO: 1997-433-221/62717

Part of Paper No. 15

Response to Amendment

1. Applicant's arguments with respect to claims 1-33 have been considered but are moot in view of the new ground(s) of rejection. Although the above identified Application is not in condition for allowance, the Examiner thanks the Applicant for his effort and for the numerous informal telephone interviews to seek an early disposal of the case.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. While claims 1, 9, 16 and 24 recite the limitation "second data for describing device dependent spatial information content of the image", the specification says: "second data for describing a device dependent transformation of spatial information content of the image" (page 3, lines 11-13). Hence, it would not enable an ordinary artisan to make and/or use the invention.

4. Since claims 2-8, 10-15, 17-23 and 25-33 depend directly or indirectly on claims 1, 9, 16 and 24, they are also rejected for the same reason set forth above for claims 1, 9, 16 and 24.

Claims 9, 16 and 24 are rejected under 35 U.S.C. 112, first paragraph, as containing

subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claims recite the limitation ". . through use of measured chromatic stimuli and device response characteristic functions. . , spatial stimuli. . ", this limitations are not supported by the specification. Only a cursory is mention of these units is made on page 3, line 8. It is not understood exactly the advantage of using this unit within the scope of the invention nor whether applicant is making use of a known off-the-shelf unit.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

6. Claims 1, 9, 16 and 24 rejected under 35 U.S.C. 102(e) as being anticipated by Stokes (5,881,209).

With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent

spatial, i.e, XYZ space, coordinates, location, etc. . , information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43).

With regard to claim 9, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc. . , information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure 1 clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 51).

Claim 16 is rejected the same as claim 9 except claim 16 is an apparatus claim. Thus, argument similar to that presented above for claim 9 is applicable to claim 16.

With regard to claim 24, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability sball not be negatived by the manner in which the invention was made.

8. Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stokes (5,881,209) in view of Laumeyer, et al (5,572,632).

With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc.. , information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43). It is extremely well known that images not only contain color information but also spatial information. Stokes discloses various ways of describing the spatial information as set forth above. Stokes does not explicitly use the language "spatial information". However, this feature is clearly taught by Laumeyer, et al (col. 10, line 56 - col. 11, line 49).

Stokes and Laumeyer, et al are combinable because they are from a similar problem solving area, i.e., generating device profiles (col. 15, lines 7-29), for example. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Laumeyer, et al with Stokes. The motivation for doing so is for no other reason than to replace the various terminology used by Stokes, such as, XYZ space, location, coordinates

with the specific language of spatial information (see entire document). Therefore, it would have been obvious to combine Laumeyer, et al with Stokes to obtain the invention as specified in claim 1.

With regard to claim 9, Stokes discloses generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc.. , information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure 1 clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 51).

Claim 16 is rejected the same as claim 9 except claim 16 is an apparatus claim. Thus, argument similar to that presented above for claim 9 is applicable to claim 16.

With regard to claim 24, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

9. Claims 1-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stokes (5,881,209) in view of Cottrell, et al (5,694,484).

With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc.., information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43). It is extremely well known that images not only contain color information but also spatial information. Stokes discloses various ways of describing the spatial information as set forth above. Stokes, however, does not explicitly use the language "spatial information". However, this feature is clearly taught by Cottrell, et al (col. 17, line 55 - col. 19, line 13), for example.

Stokes and Cottrell, et al are combinable because they are from a similar problem solving area, i.e., generating device profiles (abstract, #21A, Fig. 2), for example. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Cottrell, et al with Stokes. The motivation for doing so is for no other reason than to replace the various terminology used by Stokes, such as, XYZ space, location, coordinates with the specific language of spatial information (col. 34, line 32). Therefore, it would have been obvious to combine Cottrell, et al with Stokes to obtain the invention as specified in claim 1.

With regard to claim 2, Cottrell further discloses the second data is represented by a first characteristic function describing added noise characteristic (abstract; column 18, lines 3-52).

With regard to claims 3, 7 and 8, as best understood, claims 1 and 2 encompass the limitations of these claims and thus they are met by the prior art. As to Weiner Noise Spectra/Spectrum, applicants' attention is invited to (col. 18, line 53 - col. 19, line 2 of Cottrell, et al).

With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48).

Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.

With regard to claim 9, Stokes discloses generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, i.e, XYZ space, coordinates, location, etc.. , information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure 1 clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 51).

With regard to claim 33, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

Claims 10, 14, and 15 are rejected the same as claims 3, 7, and 8. Thus, arguments similar to those presented above for claims 3, 7, and 8 are applicable to claims 10, 14, and 15.

Claim 11 is rejected the same as claim 4. Thus, argument analogous to that presented above for claim 4 is applicable to claim 11.

Claims 12 and 13 are rejected the same as claims 5 and 6. Thus, arguments similar to those presented above for claims 5 and 6 are applicable to claims 12 and 13.

Claim 16 is rejected the same as claim 9 except claim 16 is an apparatus claim. Thus, argument similar to that presented above for claim 9 is applicable to claim 16.

Claim 17 is rejected the same as claim 2 except claim 17 is an apparatus claim. Thus, argument analogous to that presented above for claim 2 is applicable to claim 17.

Claims 18, 22, and 23 are rejected the same as claims 3, 7, and 8 except claims 18, 22, and 23 are apparatus claims. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 18, 22, and 23.

Claim 19 is rejected the same as claim 4 except claim 19 is an apparatus claim. Thus, argument analogous to that presented above for claim 4 is applicable to claim 19.

Claims 20 and 21 are rejected the same as claims 5 and 6 except claims 20 and 21 are apparatus claims. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 20 and 21.

With regard to claim 24, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

Claim 25 is rejected the same as claim 2. Thus, argument similar to that presented above for claim 2 is applicable to claim 25.

Claims 26, 30, and 31 are rejected the same as claims 3, 7, and 8. Thus, arguments analogous to those presented above for claims 3, 7, and 8 are applicable to claims 26, 30, and 31.

Claim 27 is rejected the same as claim 4. Thus, argument similar to that presented above for claim 4 is applicable to claim 27.

Claims 28 and 29 are rejected the same as claims 5 and 6. Thus, arguments analogous to those presented above for claims 5 and 6 are applicable to claims 28 and 29.

Claim 32 is rejected the same as claim 9. Thus, argument similar to that presented above for claim 9 is applicable to claim 32.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CAR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CAR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel G. Mariam whose telephone number is (703) 305-4010.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau, can be reached on (703)305-4706. The fax phone number for this group is (703)308-5397.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

DGM

September 17, 1999

Phuoc Tran

PHUOC TRAN
PRIMARY EXAMINER

12/23/99 13:51 FAX 781 386 8435 POLAROID PATENT DEPT. 001

◆Polaroid

Law & Patent Division

Polaroid Corporation
784 Memorial Drive
Cambridge, MA 02139
781 386 8474
781 386 8435 / Fax
deckerr@polaroid.com

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To: Examiner Daniel G. Mariam — **BOX AF**
United States Patent and Trademark Office
Group Art Unit: 2721

Fax No.: 703-308-5397 **Tel No.:** 703-305-4010

FAX RECEIVED
DEC 23 1999
Group 2700

From: Robert J. Decker

Date: December 23, 1999

Re: Notice of Appeal and Amendment After Final for Patent Application Serial No. 08/709,487
Filed 9/6/96 by Hultgren et al.
Title: Device Profiles for Use in a Digital Image Processing System
Attorney Docket No. 8166/RJD

Total Pages (including cover sheet): 1 page

Certificate of Transmission under 37 CFR 1.8

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office on December 23, 1999.

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

Dear Examiner Mariam:

Thank you for your Final Office Action dated September 24, 1999. As per my voice-mail message of December 23, 1999, I have filed an Amendment (§1.116) and Notice of Appeal. In accordance with your §112(1) rejections we have amended the claims to conform with your suggestion.

With regard to the §§102 and 103 issues, perhaps we could have an Examiners Interview. I would be very happy to set up a conference telephone call having the following coinventors and Image Science Practitioners present:

OFFICIAL

Dr. Bror Hultgren
Dr. Jay Thornton
Dr. Dick Cottrell
Dr. Julian Bullitt
Dr. Orlando Lopez

Thank you for your assistance in this matter.

Best regards,

Rob Decker

AF/GP-2721
user is not listed
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Docket No. C-8166/RJD

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Serial No.: 08/709,487 — Art Unit: 2721
Filed: September 6, 1996 — Examiner: D. Mariam
By: Hultgren et al.
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

[redacted]
20340

BOX AF
Assistant Commissioner for Patents
Washington, D.C. 20231

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I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Date: December 24, 1999

Robert J. Decker
Attorney for the Applicant Under 37 C.R.R. § 1.34(a)
Registration No. 44,056

NOTICE OF APPEAL FROM THE PRIMARY EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES (37 C.F.R. § 1.191)

Sir:

Applicants hereby appeal to the Board from the decision of the Examiner mailed September 24, 1999, finally rejecting claims 1 to 33.

The fee for this Notice of Appeals pursuant to 37 C.F.R. § 1.17(b) is $300.00, which can be charged to Deposit Account No. 16-2195.

An Amendment (dated December 23, 1999) pursuant to 37 C.F.R. § 1.116 is being filed concurrently herewith.

Please charge any additional fee due, or credit any overpayment, to Deposit Account No. 16-2195.

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Respectfully submitted,

Robert J. Decker
Attorney Acting Under 37 C.F.R. 1.34(a)
Registration No. 44,056

Tel: 781-386-6474
Fax: 781-386-6435

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Docket No. C-8166/RJD

PATENT

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1-15-00
(AE)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

OIPE JC25 DEC 30 1999 PATENT & TRADEMARK OFFICE

Serial No.: 08/709,487
Filed: September 6, 1996
By: Hultgren et al.
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Art Unit: 2721
Examiner: D. Mariam

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Date: December 24, 1999

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

AMENDMENT UNDER 37 C.F.R § 1.116

Sir:

In response to the Final Office Action dated September 24, 1999, having a three (3) month shortened statutory period set to expire December 24, 1999, please amend the above captioned application as follows:

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IN THE CLAIMS:

Please amend claims 1, 9, 16, 24, and 33 as follows:

1. (THRICE AMENDED) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:

first data for describing a device dependent transformation of color information content of the image to a device independent color space; and

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second data for describing a device dependent transformation of spatial information content of the image in said device independent color space.

10 ~~9~~. (THRICE AMENDED) A method of generating a device profile that describes properties of a device in a digital image reproduction system for capturing, transforming or rendering an image, said method comprising:

generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli and device response characteristic functions;

generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions; and

combining said first and second data into the device profile.

18 ~~16~~. (THRICE AMENDED) A digital image processing system using a device profile for describing properties of a device in the system to capture, transform or render an image, said system comprising:

means for utilizing first data of the device profile for describing a device dependent transformation of color information content of the image to a device independent color space through use of chromatic response characteristic functions; and

means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device independent color space through the use of spatial characteristic functions describing image spatial transform characteristics in said device independent color space.

26 ~~24~~. (THRICE AMENDED) A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

11 ~~33~~. (ONCE AMENDED) The method of claim ~~9~~ 10 wherein, for said device:

[the first] said second data is represented by a [color] first characteristic function describing added noise characteristics[;] and [the second data is represented by a spatial] a second characteristic function describing image signal transform characteristics.

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REMARKS

I. STATUS OF THE CLAIMS

Claims 1-33 are pending in the application.

Claims 1, 9, 16, and 24 are independent claims.

Claims 1-33 stand rejected under 35 U.S.C. § 112(1).

Claims 1, 9, 16, and 24 stand rejected under 35 U.S.C. § 102.

Claims 1-31 stand rejected under 35 U.S.C. § 103.

II. AMENDMENTS

As discussed in greater detail below, the claims have been amended to clarify the invention in response to the Examiner's rejection under 35 U.S.C. § 112, first paragraph,.

It is believed that the amendments do not involve the addition of any new matter.

III. NOTICE OF APPEAL

Please note that a Notice of Appeal is being filed concurrently herewith under 37 C.F.R. § 1.191.

IV. INTRODUCTION

As an introduction to discussing the Examiner's rejections to the pending patent application, the Applicants would like to propose what basic knowledge could be assumed of a practitioner of image science (i.e. one of ordinary skill in the arts which encompass the field of the Applicants' present invention). Such practitioner would at a minimum be familiar with

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color science as taught in volumes such as Hunt[1] and Stiles and Wyszecki[2] for understanding the concepts and formalism of describing color and tone reproduction. Further, the practitioner of image science would be familiar with the concepts of spatial micro image structure and processing as taught in Dainty and Shaw[3] and Castleman[4].

Based on these sources, the Applicants would like to respectfully clarify apparent confusions in the Examiner's response both in the use of spatial and color space coordinate systems and in the types of transformations being applied.

Part of the confusion arises because the same nomenclature is often used in the image science field to mean different things in different situations — e.g. the Cartesian spatial coordinates may be referred to as xyz while color space coordinates are often described in terms of the tristimulus coordinates XYZ. While the nomenclature is often not unique, the practitioner of ordinary skill in the arts of image science understands the meaning WITHIN the CONTEXT of the usage of the terminology.

A complete description of an image must describe the color at each point in the image. For a two-dimensional image this means that the color must be specified at each position in the image, given by two "spatial coordinates" x and y. Color images are usually described as being a function defining three color values for each independent spatial location. It is this formulation that is applied in the specification of the Applicants' present invention (see page 5, lines 18-20). Some common color descriptions are device dependent like {rgb} for a specific camera; others are device independent color spaces either like the uniform color space {L*a*b*} or the tristimulus coordinates {XYZ}.

The concept of a transformation is defined as a physical "act of changing markedly the form or appearance" of an entity, or as a mathematical "mapping of one space onto another or into itself"[5]. The term space is used here in the mathematical sense, i.e., a space is a set of n-tuples where n is the dimensionality of the space. A transformation, in the sense that it is used in the specification and claims of the Applicants' pending Application, is a prescription for establishing a connection, or mapping, between a group of points in one

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[1] Hunt, R.W. G., *The Reproduction of Color*, 4th ed., Fountain Press, London (1975).
[2] Stiles, W. S. & Wyszecki, G. *Color Science*, 2nd ed., Wiley, New York (1982).
[3] Dainty J. C., & Shaw, R., *Image Science*, Academic Press, London (1974).
[4] Castleman K.R., *Digital Image Processing*, Prentice-Hall, Englewood Cliffs (1979).

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space to another group of points in the same or a different space. The meaning of the term "transformation" is evident to the practitioner of ordinary skill in terms of the context. In the context of this introduction, the term "transformation" is summarized as follows:

- Transformations applied to the color space coordinate — e.g. transforming the device dependent video {rgb} triplet to a device independent tristimulus triplet {XYZ}. Such transformations are associated with color management systems and color management (cf. Laumeyer,[6] Column 8, lines 11-32).
- Point transformations applied at each spatial location, independent of neighboring spatial locations to change the color of the image at that point. Examples are contrast and brightness adjustments that affect the color description at that point in the image within a fixed color space and 'gamma' correction for CRT display (cf. Hunt, p. 393-396).
- Transformations applied to the spatial (in the sense of real space such as distance in an image) coordinate systems — e.g. the process of digital zoom will transform the image spatial coordinate {xy} to a new coordinate {x'y'} (cf. Cottrell,[7] column 21, lines 48-65).
- Transformations applied to the image information represented in a spatial coordinate system (e.g. Cartesian) to convert that into a complex coordinate representation in terms of spatial frequency and phase — these transformations are known as Fourier Transforms (see Applicants' specification at page 5, line 18 to page 6, line 8).
- Convolution is a transformation that is applied over a neighborhood of spatial locations, to change the value of the image at one point based on its value and the values at the surrounding positions — e.g. the effect of blurring could be modeled by convolution (see Applicants' specification at page 6, eq. 5).

A practitioner of ordinary skill in the art of image science will be familiar with all of these types of transformations and will recognize that the initial two, as listed above, are concerned with Color Management. The purpose of such Color Management Systems is discussed in the exposition of prior art for this pending Application and is the subject matter

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[5] *The American Heritage Dictionary*, Houghton Mifflin, Boston (1976).
[6] Laumeyer, R. A., Laurel C. J., U.S. Patent No. 5,572,632 (1996) [cited in 9/24/99 Final Office Action].

of the patents of Stokes[8] and Laumeyer et al. A practitioner of the art of image science will recognize that the latter three, as listed above, are concerned with the Spatial Management of the imaging process. The concept of Spatial Management is proposed as a corresponding technique to Color Management in the Cottrell '484 patent. In general, as an indication of the extent to which the invention is not evident to one skilled in the art, we reference a technical paper by MacDonald[9], entitled *Framework for an Image Sharpness Management System*. The author Lindsay MacDonald is associated with The Color and Imaging Institute of the University of Darby. This Institute is advertising for a two year Post Doctoral Fellow to perform research work relating to the development of a computational framework for image sharpness management. The work is being funded by an American computer company with close ties to the development of ColorSync. Whereas the Applicants' present invention addresses a system and method for furnishing the data structures required for such a Spatial Management system, i.e., to apply a device independent paradigm to spatial processing in a digital image processing system (See Applicants' specification, page 2, lines 25-28).

V. CLAIMS 1-33 ENABLE ONE SKILLED IN THE ART TO MAKE OR USE THE INVENTION WITHIN THE MEANING OF 35 U.S.C. § 112, ¶ 1, IN VIEW OF THE AMENDMENTS TO THE CLAIMS.

A. Base Claims 1, 9, 16, and 24, and Respective Dependent Claims

Claims 1-33 stand rejected under 35 U.S.C. § 112, first paragraph, as being non-enabling for failing to describe the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In particular, the Office Action states:

> Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. While claims 1, 9, 16 and 24 recite the limitation "second data for describing device dependent spatial information content of the image", the specification says: "second data for describing a device dependent

[7] Cottrell F. R., Hultgren B. O., U.S. Patent No. 5,694,484 (1997) [cited in 9/24/99 Final Office Action].
[8] Stokes, M., U.S. Patent No. 5,881,209 (1999) [cited in 9/24/99 Final Office Action].
[9] Macdonald, L. *Framework for an Image Sharpness Management System*, Proceedings of The Seventh Color Imaging Conference, 1999.

> ***transformation of*** spatial information content of the image" (page 3, lines 11 - 13). Hence, it would not enable an ordinary artisan to make and/or use the invention (emphasis provided).

(See Office Action, para. 3, page 2)

Applicants have amended the claims to particularly point out and distinctly claim the Applicants' invention. In response to the Examiner's rejection, base claims 1, 9, 16, and 24 have been amended by <u>reinserting</u> the phrase "transformation of" as originally filed.

B. <u>Base Claims 9, 16, And 24, And Respective Dependent Claims</u>

Claims 9-31 and 33 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification. In particular, the Office Action states:

> Claims 9, 16, 24 are rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claims recite the limitation ". . through use of measured chromatic stimuli and device response characteristic functions. . , spatial stimuli. . ", this limitations are not supported by the specification. Only a cursory is mention of these units is made on page 3, line 8. It is not understood exactly the advantage of using this unit within the scope of the invention nor whether applicant is making use of a known off-the-shelf unit. Claim 2, line 2, it is not clear what is meant by "contact section rounded section".

(See Office Action, para. 4, pages 2-3)

Applicants respectfully traverse the rejection of the claims under 35 U.S.C. § 112 (1) and assert that according to one skilled in the art, the claims as recited in the Applicants' pending application contain subject matter which was indeed described in the specification. For example, in base claims 9 and 24, one skilled in the art would appreciate that a spatial stimulus is "something that incites" the system "to action" and is therefore synonymous to an input to the system (Dainty and Shaw, pp.204-206, Section 6.2). Referring to page 6, lines 17-19 of the Applicants' specification, it states that "If the input image [stimulus] is an uniform image $I(x,y) = I_0$, Fourier analysis of the output image [response] will yield the Wiener Noise Power Spectrum $\mathcal{N}(u,v)$ which is the characteristic function for the imaging

device". Thus, as one skilled in the art would appreciate, that the use of the terms "stimuli" and "response" are described in the specification. Therefore, the specification is complete, in light of the claimed subject matter, to those of ordinary skill in the art.

Please note that "spatial stimuli" and "device response" was not specifically recited in base claim 16, and therefore this particular aspect of the Office Action would not be applicable.

Finally, it is unclear from the context how the term "unit(s)" is being applied on three occasions in the last three lines of para. 4, page 3 of the Office Action.

For the above reasons, Applicants respectfully request that the Examiner's rejection of claims 1-33 for lacking enablement/description under 35 U.S.C. § 112 (1) be withdrawn.

VI. CLAIMS 1, 9, 16, AND 24 ARE NOT ANTICIPATED UNDER 35 U.S.C. § 102 (e) BY STOKES BECAUSE THE PRIOR ART RELIED ON BY THE EXAMINER FAILS TO DISCLOSE THE APPLICANTS' INVENTION.

Claims 1, 9, 16, and 24 were rejected under 35 U.S.C. § 102(e) as being anticipated by Stokes U.S. Patent No. 5,881,209. Applicants respectfully traverse the rejection of amended claims 1, 9, 16, and 24 as being anticipated by Stokes because Stokes fails to disclose the Applicants' present invention as recited as follows:

a) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 1 which calls for:

> ...second data for describing a device dependent transformation of spatial information content of the image in said device independent color space;

b) a method intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 9 which calls for:

> ...generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions;

c) an image processing system for capturing, transforming, or rendering an image, as recited in amended base claim 16 which calls for:

> ...means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device

independent color space through the use of spatial characteristic functions describing image spatial transform characteristics in said device independent color space;
and/or

d) a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising

data for describing a device dependent transformation of spatial information content of the image to a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by spatial characteristic functions.

In particular, the Office Action states with regards Stokes:

> With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:
> first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e., XYZ space, coordinates, location, etc. . , information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43) **[1]**.
> With regard to claim 9, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:
> generating first data for describing a device dependent transformation of color information **content of the** image to a device independent color space through use of measured chromatic **stimuli**, i.e., for **example,** XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, i.e., XYZ space, coordinates, location, etc. . , information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the **mouse** "20", shown in Figure I clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 51). **[2]**

(See Office Action, para 6. pages 3-4, emphasis provided).

1: Stokes discloses, claim 1, creating a color printer profile beginning with a target having a plurality of color samples thereon and printing images on said printer using said profile. In the specification, (Stokes, col. 5, lines 10-36), Stokes describes how a CMM first converts the color data from the device dependent color space within the source color devices to a device independent color space such as CIE XYZ space. Any ordinary artisan would

know that the XYZ space is a color space as taught by Schreiber[10] (Schreiber, p. 177). In contrast, spatial information content of the image would not be expressed using XYZ space as the independent variable. For example , it would not be possible to perform the characterization of spatial content described in Fig. 12, p. 245 of "Dainty and Shaw" in the color XYZ space. To avoid confusion, it is useful to refer to the coordinate system that describes "real space" (such as distance in an image – in inches, or angular variation) as s1, s2, s3 instead of lower case "x, y, z". In order to avoid confusion with the XYZ color space, the abscissa in the edge spread function and the line spread function in Fig. 12, p. 245 of "Dainty and Shaw" should be labeled s1. The ordinate could, in some cases, be related to the color space units. Thus, contrary to the Office Action, Stokes does not in any part of the referenced patent disclose or refer to any such determination of spatial content and therefore does not anticipate the base claims of the Applicants present invention.

2: See note 1. Also, as one skilled in the art would appreciate, and contrary to the Office Action, the mouse, shown in Figure 1 of Stokes, would not be able to "clearly generate spatial stimuli and device response characteristic functions" using the method described by Fig. 12, p. 245 of "Dainty and Shaw". Rather, as one skilled in the art would appreciate, the measurement of micro-image properties such as MTF and the Weiner spectrum of noise requires some form of a microdensitometer for analysis (rather than a mouse as suggested by the Office Action) of the developed image.

In summary, neither Stokes nor the cited prior art discloses the system and method of the Applicants' present invention as cited in the base claims above.

Accordingly, as anticipation under 35 U.S.C. § 102 requires that each and every element of the claim be disclosed in the prior art reference, it is respectfully submitted that neither Stokes nor the applied prior art anticipate the base claims 1, 9, 16, and 24. Claims 2-8, 10-15, 17-23, and 25-33 are dependent from the base claims and includes all limitations of the base claims.

In view of difference between claims 1-33 and Stokes, Applicants respectfully urge that the rejections of claims 1-33 be withdrawn.

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[10] Schreiber, W. F., *Fundamentals of Electronic Imaging Systems*, 2nd ed., Springer-Verlag, Germany (1991).

VII. AMENDED CLAIMS 1, 9, 16, AND 24 ARE PATENTABLE UNDER 35 U.S.C. § 103 OVER STOKES 5,881,209 IN VIEW OF LAUMEYER BECAUSE THE APPLIED PRIOR ART TAKEN AS A WHOLE FAILS TO SUGGEST THE APPLICANTS' INVENTION

Claims 1, 9, 16 and 24 are rejected under 35 U.S.C. § 103 as being unpatentable over Stokes U.S. Patent 5,881,209 in view of Laumeyer et al. U.S. Patent 5,572,632 (hereinafter "Laumeyer").

Applicants respectfully submit that claims 1, 9, 16, and 24 would not have been obvious under 35 U.S.C. § 103 over Stokes in view of Laumeyer because the applied prior art fails to teach or suggest the Applicants' present invention as recited as follows:

a) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 1 which calls for:

> ...second data for describing a device dependent transformation of spatial information content of the image in said device independent color space;

b) a method intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 9 which calls for:

> ...generating second data for describing a device dependent transformation of spatial information content of the image in said device independent color space through use of spatial stimuli and device response characteristic functions;

c) an image processing system for capturing, transforming, or rendering an image, as recited in amended base claim 16 which calls for:

> ...means for utilizing second data of the device profile for describing a device dependent transformation of spatial information content of the image in said device independent color space through the use of spatial characteristic functions describing image spatial transform characteristics in said device independent color space;

and/or

d) a device profile intended for an image reproduction system for capturing, transforming, or rendering an image, as recited in amended base claim 24 which calls for:

> ...said device profile comprising data for describing a device dependent transformation of spatial information content of the image in a device independent color space, wherein through use of spatial stimuli and device response for said device, said data is represented by characteristic functions.

In particular, the Final Office Action states with regards to Stokes and Laumeyer:

> With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:
>
> first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e., XYZ space, coordinates, location, etc.., information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43). It is extremely well known that images not only contain color information but also spatial information. Stokes discloses various ways of describing the spatial information as set forth above. Stokes does not explicitly use the language "spatial information". However, this feature is clearly taught by Laumeyer, et al (col. 10, line 56 - col. 11, line 49) **[3]**.
>
> Stokes and Laumeyer, et al are combinable because they are from a similar problem solving area, i.e., generating device profiles (col. 15, lines 7-29), for example. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Laumeyer, et al with Stokes. The motivation for doing so is for no other reason than to replace the various terminology used by Stokes, such as, XYZ space, location, coordinates with the specific language of spatial information (see entire document). Therefore, it would have been obvious to combine Laumeyer, et al with Stokes to obtain the invention as specified in claim 1 **[4]**.
>
> With regard to claim 9, Stokes discloses generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device dependent spatial, Le, XYZ space, coordinates, location, etc.., information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure l clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 5 1) **[5]**.
>
> Claim 16 is rejected the same as claim 9 except claim 16 is an apparatus claim. Thus, argument similar to that presented above for claim 9 is applicable to claim 16.
>
> With regard to claim 24, as best understood, claim 9 encompasses the limitation of this claim and thus it is met by the prior art.

(See Office Action, para 8, pages 5-6).

3: As described by Laumeyer, the L*a*b* color space is used as the device independent color space (e.g., the L*a*b* color space is described in Schreiber, p.182). As one skilled in

the art would appreciate, spatial information content of the image would not be expressed using L*a*b* space as the independent variable. For example, it would not be possible to perform the characterization of spatial content described in Fig. 12, p. 245 of "Dainty and Shaw" using only the color L*a*b* space. Contrary to the Office Action, when Laumeyer refers to a "spatial location" in L*a*b* space, any ordinarily skilled artisan would understand that Laumeyer refers to a triplet (L*,a*,b*) that describes a color value (i.e., "spatial location" refers to location in a space in the mathematical sense). Contrary to the Office Action, Stokes does <u>not</u> in any part teach or suggest any such determination of spatial content. Similarly, contrary to the Office Action, Laumeyer <u>only</u> refers to <u>color</u> spaces.

4: See note 3.

5: See notes 1 and 2.

In summary, the Examiner's reliance on Laumeyer's image data processing system does not supply the deficiencies of the Stokes disclosure vis-à-vis Applicants' base claims 1, 9, 16, and 24. Accordingly, neither Stokes, nor Laumeyer taken alone, or in combination, would have suggested Applicants' invention of base claims 1, 9, 16, and 24. Claims 2-8, 32, 10-15, 33, 17-23, and 25-31 are dependent from claims 1, 9, 16, and 24, respectively, and include all the limitations of the latter claims. A dependent claim contains all the limitations of the independent claim upon which it depends and is non-obvious under Federal Circuit guidelines if the independent claim upon which it depends is allowable.

VIII. AMENDED CLAIMS 1-33 ARE PATENTABLE UNDER 35 U.S.C. § 103 OVER STOKES 5,881,209 IN VIEW OF COTTRELL ET AL. BECAUSE THE APPLIED PRIOR ART TAKEN AS A WHOLE FAILS TO SUGGEST THE APPLICANTS' INVENTION

Claims 1-33 are rejected under 35 U.S.C. § 103 as being unpatentable over Stokes U.S. Patent 5,881,209 in view of Cottrell et al. U.S. Patent 5,694,484 (hereinafter "Cottrell").

Applicants respectfully submit that base claims 1, 9, 16, and 24 would not have been obvious under 35 U.S.C. § 103 over Stokes in view of Cottrell because the applied prior art fails to teach or suggest the Applicants' image reproduction system/method/profile for

capturing, transforming, or rendering an image as recited in base claims 1, 9, 16, and 24, respectively (see Section VII above for recitation of claims in part).

In particular, the Office Action states with regards to Stokes and Cottrell:

> With regard to claim 1, Stokes discloses a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image (abstract), for example, comprising:
>
> first data for describing a device dependent transformation of color information content of the image to a device independent color space and second data for describing device dependent spatial, i.e., XYZ space, coordinates, location, etc.., information content of the image in the device independent color space (#60, Figure 4; col. 5, lines 10-43). It is extremely well known that images not only contain color information but also spatial information. Stokes discloses various ways of describing the spatial information as set forth above. Stokes, however, does not explicitly use the language "spatial information". However, this feature is clearly taught by Cottrell, et al (col. 17, line 55 - col. 19, line 13), for example.
>
> Stokes and Cottrell, et al are combinable because they are from a similar problem solving area, i.e., generating device profiles (abstract, #21A, Fig. 2), for example. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teaching of Cottrell, et al with Stokes. The motivation for doing so is for no other reason than to replace the various terminology used by Stokes, such as, XYZ space, location, coordinates with the specific language of spatial information col. 34, line 32). Therefore, it would have been obvious to combine Cottrell, et al with Stokes to obtain the invention as specified in claim 1 [6].
>
> With regard to claim 2, Cottrell further discloses the second data is represented by a first characteristic function describing added noise characteristic (abstract; column 18, lines 3-52).
>
> With regard to claims 3, 7 and 8, as best understood, claims 1 and 2 encompass the limitations of these claims and thus they are met by the prior art. As to Weiner Noise Spectra/Spectrum, applicants' attention is invited to (col. 18, line 53 - col. 19, line 2 of Cottrell, et al) [7],
>
> With regard to claim 4, Cottrell, et al discloses the pixel data essentially represents intensity level of the various colors, such as red, green and blue, comprising the image, and the color map element 84, if enabled by the image processing operation selection information, generates in response pixel data in luminance ("Y") and chrominance "u" and "v") form. The luminance and chrominance data is in spatial form (column 13, lines 42-48) [8].
>
> Claims 5 and 6 are rejected the same as claims 1, 2, and 4. Thus, arguments similar to those presented above for claims 1, 2, and 4 are applicable to claims 5 and 6.
>
> With regard to claim 9, Stokes discloses generating first data for describing a device dependent transformation of color information content of the image to a device independent color space through use of measured chromatic stimuli, i.e., for example, XYZ tristimulus values could be manually measured using a colorimeter, and device response characteristic functions and generating second data for describing device

dependent spatial, I.e, XYZ space, coordinates, location, etc.., information content of the image in the device independent color space through use of spatial stimuli, i.e., tristimulus, also, the mouse "20", shown in Figure I clearly generates spatial stimuli, and device response characteristic functions and combining the first and second data into the device profile (#60, Figure 4; col. 5, line 10 - col. 10, line 5 1) [9].

6: Stokes teaches how to "convert the color data from the device dependent color space within the source devices to device independent color space". But, as detailed above in note 1 (Section VI), Stokes does not in any part of the referenced patent describe or refer to any such determination of spatial content and therefore does not teach or suggest the Applicants' claimed invention. Cottrell teaches how to use image data from an image data source, and how to perform at least one image processing operation to generate psychovisually optimized processed image data. Some of that image data could be the Modulation Transfer function and/or the Wiener Power Spectrum, which are used to describe the spatial characteristics. These measures are well known to those schooled in the art (see, for example, "Dainty and Shaw", Chapters 7 & 8). However, Cottrell does not describe how the information is represented. If the spatial characteristics of the image are represented, as has been done historically, in a device dependent model, spatial characteristics of digital imaging devices will be modified in the context of the device dependent model. A primary object of the Applicants' present invention, as specifically stated on page 2, lines 25-28, is to apply a device independent paradigm to spatial processing in a digital image processing system. An advantage of the present invention is that it enhances processing versatility. Since Cottrell does not describe the representation and data structure for the spatial information and Stokes does not teach or suggest any such determination of spatial content, it would not be possible to combine the two references to arrive at the Applicant's claimed invention.

7: See note 6.

8: One skilled in the art would appreciate that any input device produces an image that assigns a value of the color variables (r,g,b or Yuv) to a spatial location in the image (e.g., a location in a scene being captured would be represented in the captured image by a color triplet (r, g, b) at the corresponding spatial location (s1, s2, s3)). Cottrell teaches how to

optimally process such an image. However, Cottrell does not describe how the information is represented. If the spatial characteristics of the image are represented, as has been done historically, in a device dependent model, spatial characteristics of digital imaging devices will be modified in the context of the device dependent model. A primary object of Applicants' present invention, as stated on page 2, lines 25-28, is to apply a device independent paradigm to spatial processing in a digital image processing system. An advantage of the present invention is that it will enhance processing versatility.

9: See notes 1 and 2.

In summary, the Examiner's reliance on Cottrell's image processing system does not supply the deficiencies of the Stokes disclosure vis-à-vis Applicants' base claims 1, 9, 16, and 24. Accordingly, neither Stokes, nor Cottrell taken alone, or in combination, would have suggested Applicants' invention of base claims 1, 9, 16, and 24. Claims 2-8, 32, 10-15, 33, 17-23, and 25-31 are dependent from claims 1, 9, 16, and 24, respectively, and include all the limitations of the latter claims. A dependent claim contains all the limitations of the independent claim upon which it depends and is non-obvious under Federal Circuit guidelines if the independent claim upon which it depends is allowable.

IX. CONCLUSION

Please charge any excess fees due and credit any overpayment to Charge Account No. 16-2195.

It should be noted that the above arguments are directed towards certain distinctions between the claims and the prior art cited which the Applicants believe make the pending claims patentable. However, the differences between the pending claims and the prior art cited is not necessarily limited to those distinctions.

For the foregoing reasons, Applicants respectfully urge that the instant amendment be entered, and submit that amended claims 1-33 are in condition for allowance, an indication of which is solicited.

08/709,487

THE REPRODUCTION OF COLOUR IN PHOTOGRAPHY, PRINTING & TELEVISION

R. W. G. HUNT

D.Sc. · D.I.C. · A.R.C.S. · F.R.P.S. · F.R.S.A. · M.R.T.S. · F.B.K.S.T.S.

Visiting Professor of Physiological Optics, The City University, London
Formerly Assistant Director of Research, Kodak Limited, Harrow

With a Foreword by

PROFESSOR W. D. WRIGHT · D.Sc. · A.R.C.S. · D.I.C.

Formerly Head of the Applied Optics Section, Imperial College
of Science & Technology, South Kensington, London

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Foreword

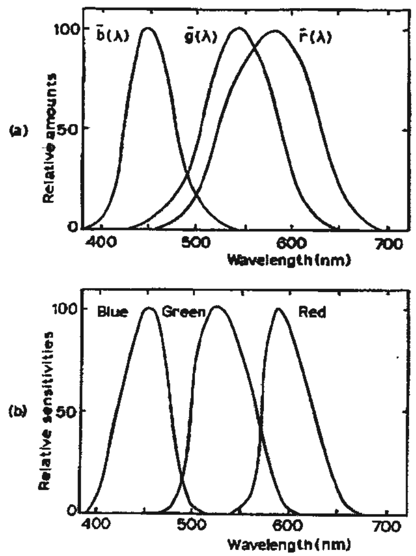
THE development of colour photography, colour television, and colour printing demands a very wide and deep understanding of the facts of colour mixture and colour perception. These methods of colour reproduction all have many interesting technical problems to solve, while physiologically the processes in the eye and the brain exercise their own subtle influences on the visual appearance of a colour reproduction. Moreover, the final assessment of a colour picture calls for aesthetic as well as scientific appraisal.

Evidently, then, a book on the reproduction of colour requires a broad outlook on the part of the author, and Dr. Hunt, with his understanding of the basic theory, his experience of commercial production, and his own contributions to fundamental research, is very well qualified to give a balanced and comprehensive account of the subject. This he has undoubtedly succeeded in doing, and in view of his original work on colour adaptation and the visual response, his comments on the subjective aspects of colour reproduction will command particular respect. However much we may regret that the requirements of a colour reproduction cannot be expressed in precise colorimetric terms, we have to recognize that engineering concepts alone are not enough.

The publication of this book will give much pleasure to Dr. Hunt's colleagues and friends, and especially to those who have had the privilege of listening to him present a paper or deliver a lecture, for the orderly presentation of his material and the clarity of his thought on such occasions deserve, and will now reach, a much wider audience. For myself, I regard it as an honour to have been invited to write this Foreword and by undertaking such an agreeable task to continue my association with Dr. Hunt, which dates from the time when he was a student at the Imperial College, and has included our co-operation in a series of courses on the Fundamentals of Colour Reproduction.

W. D. WRIGHT

…ms is that the resulting red and green curves usually overlap less than is the …r typical all-positive curves; this can be seen from Fig. 19.9 where the …est set of all-positive colour-matching functions (Yule, 1973) are com… to a set of sensitivity curves typical of those used in cameras and …imating the positive parts of colour-matching functions of the type shown … 19.7. This greater wavelength separation of the positive parts means that …n be produced more efficiently in cameras using dichroic beam-splitting …s (see Chapter 20). This advantage is gained at the price of departing …ably from correct colorimetric analysis of the scene, but Sproson has … that if positive-part sensitivity curves are used with matrixing the …etric errors likely to occur in practice can be reduced to quite small values,



…9.9 (a) The narrowest possible set of colour-matching functions. (b) Sensitivities …l of those used in television cameras and approximating the positive parts of the colour-matching functions of Fig. 19.7.

if the constants in the matrix are worked out empirically to minimize the errors for typical scene colours (Sproson, 1966). This is shown as the fifth alternative in Fig. 19.8; it is also widely used (see Section 20.10).

The neglect of the negative portions of the matching functions results, in the fourth alternative of Fig. 19.8, in the luminance signal being based, in effect, on a three-humped spectral sensitivity curve instead of on the single-humped $\bar{y}(\lambda)$ curve which is required to give true luminance; the result is that the luminances displayed on both monochrome and colour receivers suffer from errors, and these can be quite large, notably in the case of blues which are lightened appreciably. The matrixing used in the fifth alternative of Fig. 19.8 can also result in these luminance errors being greatly reduced.

The fifth alternative can be operated by carrying out the matrixing either at the camera or at the receiver. European practice is to do it at the camera, and with cameras using Plumbicon tubes, with their nearly linear response, it is theoretically correct to matrix the actual signals produced by the tubes. In the U.S.A., if matrixing is carried out, it is often done at the receiver (or monitor); since the signals at this stage are no longer linearly related to the optical image (for reasons to be described in the next section), it is not theoretically correct to matrix them at that stage. However, calculations and practical tests have shown that the resulting errors are not too large. An advantage of matrixing at the receiver is that, as new phosphors are brought out, the matrixing can be adjusted accordingly (DeMarsh, 1974).

19.13 Gamma correction

So far, a linear relation has been assumed between the electrical and corresponding optical signals at both the camera and the receiver. But the light output from receiver tubes is not linear: it is approximately proportional to the cube of the applied voltage. Thus if the logarithm of the resulting tube luminance is plotted against the logarithm of the applied voltage the slope of the line obtained (that is, the gamma) is about 3 (2.8 ± 0.3 is the accepted index for colour receivers).

From the point of view of signal-to-noise ratio, a high gamma is desirable because the darker portions of the picture, where noise is most obvious, tend to be reproduced nearly black. But while a monochrome picture which has a gamma of about 3 might be tolerable, a colour picture will exhibit severe colour distortion.

Suppose E_R, E_G, E_B are intended to produce a colour $R(\mathrm{R})+G(\mathrm{G})+B(\mathrm{B})$ on a linear display. If, instead, they are applied to a cube law display, the resulting colour is $R^3(\mathrm{R})+G^3(\mathrm{G})+B^3(\mathrm{B})$. For example, if $R=1$, $G=\frac{1}{2}$, $B=\frac{1}{2}$ and unit quantities of (R), (G), and (B) result in a white (W), then the intended colour is equivalent to $\frac{1}{2}(\mathrm{W})+\frac{1}{2}(\mathrm{R})$. But the displayed colour will be $R=1$, $G=\frac{1}{8}$, $B=\frac{1}{8}$, or $\frac{1}{8}(\mathrm{W})+\frac{7}{8}(\mathrm{R})$. Hence the luminance has decreased, and the saturation has increased. A simple means of correcting for this is to pre-distort the signals E_R, E_G, E_B, at the transmitter to $E_R^{1/\gamma}$, $E_G^{1/\gamma}$, $E_B^{1/\gamma}$; the luminance signal is then

transmitted as $E_Y' = lE_R^{1/\gamma} + mE_G^{1/\gamma} + nE_B^{1/\gamma}$, and the colour-difference signals as $E_R^{1/\gamma} - E_Y'$ and $E_B^{1/\gamma} - E_Y'$.

At the receiver the corresponding green colour-difference signal $E_G^{1/\gamma} - E_Y'$ is obtained thus:

$$E_G^{1/\gamma} - E_Y' = -\frac{l}{m}(E_R^{1/\gamma} - E_Y') - \frac{n}{m}(E_B^{1/\gamma} - E_Y')$$

Then by adding E_Y' to all three colour-difference signals the voltages $E_R^{1/\gamma}$, $E_G^{1/\gamma}$, $E_B^{1/\gamma}$, are recovered, and can be applied to the appropriate tubes (with power law γ) to give the correct R, G, B.

This method gives distortionless large-area reproduction. But the luminance carried by E_Y' (which would be displayed by a monochrome receiver all over the picture, and by a colour receiver in fine detail) is $(E_Y')^\gamma$. The ratio of luminance carried by E_Y' to the true luminance is:

$$\frac{(E_Y')^\gamma}{E_Y} = \frac{(lE_R^{1/\gamma} + mE_G^{1/\gamma} + nE_B^{1/\gamma})^\gamma}{lE_R + mE_G + nE_B}$$

For the worst case (saturated blue) this ratio is:

$$\frac{n^\gamma E_B}{nE_B} = n^{\gamma - 1} = 0.11^{1.8} = 0.019$$

assuming values of 0.11 for n and 2.8 for γ which are fairly typical.

So in this case the luminance signal E_Y carries only 2% of the true luminance; hence small-area saturated colours are reproduced too dark. Also compatibility suffers, as a monochrome receiver will display too little luminance; however, in practice, the effect of the non-linearity of the cathode-ray tube characteristic on the dots produced by the chrominance signals increases the 2% quoted to about 5% (see Section 19.10). Thus monochrome errors are not too bad, and large area colour is correct. But as E_Y' does not carry all the luminance, the remainder must be carried by the sub-carrier modulation, and hence the constant luminance principle is not obeyed, with the result that the subjective effect of noise and interference is increased.

A further point is that, as the sub-carrier modulation is severely limited in bandwidth, definition will suffer because the luminance content of the sub-carrier will also be limited in bandwidth. But for white, $E_R = E_G = E_B$, and $\frac{(E_Y')^\gamma}{E_Y} = 1$, and for the more prevalent neutral shades the ratio will not be very much less than unity. Hence the above shortcomings are evident only for the higher saturations (see Fig. 22.4).

There are several alternative methods for gamma correction, but in general these involve additional complications at the receiver. For instance, if the luminance signal was composed *before* E_R, E_G, and E_B were predistorted and the signals transmitted were $E_R^{1/\gamma} - E_Y^{1/\gamma}$, $E_B^{1/\gamma} - E_Y^{1/\gamma}$, and $E_Y^{1/\gamma}$ then the above difficulties would not arise. But the recovery of the green signal is then much more complicated, requiring the signals first to be raised to the power γ, then mixed to

obtain E_G, then re-distorted to the power $1/\gamma$, before finally applying them to the tube.

So far, it has been assumed that the signals are pre-distorted by the full factor of $1/\gamma$. In practice, however, the gamma correction applied to the signals only amounts to raising them to the power of 1/2.2, whereas colour receivers usually have gammas of about 2.8 (±0.3). The result of this is that in the final display the gamma of the picture is increased over that of the original scene by a factor of 2.8/2.2, that is 1.273 times. This increase in displayed gamma is necessary (see Section 6.5) in order to overcome the reduction in apparent contrast caused by the dim surround conditions in which television is normally viewed (Bartleson and Breneman, 1967; Pitt and Winter, 1974); but, as can be seen from Fig. 19.10, increases in purity and shifts in dominant wavelength occur. The increases in purity can be beneficial in compensating for any losses of saturation caused by the

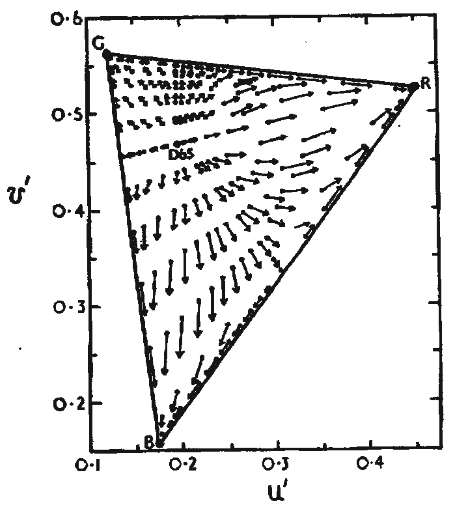


Fig. 19.10. Shifts in reproduced chromaticities resulting from altering the overall gamma of a television system from 1.0 to 1.273; a gamma of about 1.25 is required in order to offset the contrast lowering effect of the dim surround typical of normal television viewing conditions. (After Brown, 1971. Fig. 3.)

effects of the dim surround or by other factors; but the shifts in dominant wavelength can cause errors in hue. It has also been shown that, when the ambient lighting is increased to give a surround of luminance similar to the average picture-luminance, then the added flare light reduces the gamma from 1.25 to about 1.0 as required (Novick, 1969).

It has also been shown that to achieve a gamma of 1.25 in ambient lighting giving a dim surround whose luminance is about one-tenth (a typical value) of picture peak-white, the picture must be such that in the absence of ambient light it has a gamma of 1.5 (DeMarsh, 1972). This can be achieved by making adjustments to the black level of the camera so that its gamma is about 0.54 instead of 0.45 (1/2.2), or by making similar adjustments to the receiver so that its gamma is about 3.3 instead of 2.8, or by making partial adjustments to both.

When the transfer characteristic required from a gamma-reducing circuit is plotted as a voltage obtained against the voltage applied, the power-law functions involved call for ever-increasing amplification factors as the applied voltage is decreased to approach zero. Because these very high amplification factors are not realizable, the power functions are usually replaced by linear functions for low applied voltages, and the output voltages are then lower than they should be. This can cause undesirable increases in colour saturation, especially for red, orange, and yellow colours, which often have very low blue signals. The form of the linear approximation is often different from one camera to another, and this can cause undesirable changes in colour reproduction as cuts are made between cameras in a programme.

19.14 Noise reduction

Spurious signals in television give rise to random moving specks, generally called *noise*. Their harmful effects on picture quality can be reduced for stationary objects by averaging the signals over more than one frame, and this technique can result in marked improvements to the appearance of the pictures, even when some of the subject matter is moving (Sanders, 1980).

19.15 Higher definition television

The 525 and 625 line systems used for broadcast colour television were developed at a time when compatibility with monochrome receivers and economy of bandwidth were extremely important considerations. The advent of different forms of transmission, including satellite broadcasting, and both conventional and fibre-optic cable systems, means that signals requiring much broader bandwidth can be considered.

The Japan Broadcasting Corporation (NHK, Nippon Hoso Kyokai) and the BBC have proposed 1125 and 1501 line systems (Fink, 1980), as shown in Table 19.2. Neither of these systems would be compatible with existing systems, but proposals have been made for a 1249 line system (as also shown in Table

19.2), which would be compatible with existing 625 line systems. Compatibility could be achieved by transmitting the signal in two parts, one which would produce a 625 line picture on existing receivers, and the second which, together with the first, would produce a 1249 line picture on higher definition receivers; various ways have been proposed for combining the signals, one of which would add extra picture areas on either side of the compatible picture area to give an aspect ratio of about 8 to 3. As indicated in Table 19.2, a wider aspect ratio is usually considered a desirable feature of higher definition systems. An improved separation of the luminance and chrominance signals is also usually planned, either by using separate bandwidths, or by using more sophisticated methods of band sharing, or by using time sharing over line-scan periods by means of time compression devices. Displayed pictures of larger size are usually proposed, either by means of larger shadow-mask type tubes, or by projection devices, or by flat panel displays when technology permits. Broadcast transmission would have to be in the gigahertz (GHz) range of frequencies (usually 10 to 90 GHz, that is, 10 000 to 90 000 MHz).

TABLE 19.2

Parameters for proposed higher definition television

System	1125 line	1501 line	625 Compatible
Aspect ratio	5:3 or 2:1	8:3	4:3 or 8:3
Lines per picture	1125	1501	1249
Field frequency	60 Hz	60 Hz	50 Hz
Interlace ratio	2:1	2:1	2:1
Luminance bandwidth	20 MHz	50 MHz	10 MHz
Chrominance bandwidths	7.0 MHz 5.5 MHz	12.5 MHz 12.5 MHz	4 MHz 4 MHz

When space satellites are used for broadcasting, the form of the signals has to be revised to minimize power consumption, and proposals have been made to avoid luminance-chrominance band sharing by using time compression techniques over line-scan periods. For receivers to take full advantage of this, they would have to have the option of operating in this alternative mode.

19.16 Videoconferencing

A great deal of time and money is spent in attending business conferences, and the use of television is attractive as a more adequate substitute than is offered by telephone calls. The use of standard broadcast signals in this application is difficult because of their wide bandwidth, and systems using suitable compression of the information have been developed. In one such system, digital signals of only 2 megabits per second are used; but higher definition is obtained than would normally be expected from this rate, by storing the signals frame by

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Image Science

principles, analysis and evaluation of photographic-type imaging processes

J. C. DAINTY
Department of Physics, Queen Elizabeth College, University of London, London, England

and

R. SHAW
Xerox Corporation, Webster Research Center, N.Y. 14580, U.S.A.

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Convolution has the effect of smoothing out the true transform, and this smoothing is more pronounced for small m in this computed example. Truncation errors have been investigated in more detail by Tatian[20].

The sampling interval δx is another variable of practical interest. The sampling interval used in both Figs. 6 and 7 gives a Nyquist frequency, u_{max}, equal to 1000 cycles/mm, but we may only be interested in the transform up to one or two hundred cycles/mm. Suppose for example that the transform is required up to 125 cycles/mm: by the sampling theorem the interval δx need only be $4\ \mu m = 0{\cdot}004$ mm for $u_{max} = 125$ cycles/mm. In Fig. 8 the effect of increasing the sampling interval is shown, with intervals of:

(a) $0{\cdot}5\ \mu m$; (b) $1\ \mu m$; (c) $2\ \mu m$; (d) $4\ \mu m$.

In each case the total range of the function has been kept the same, the number of sampling points thus decreasing as the sampling interval increases.

It is clear from Fig. 8 that if the sampling interval is selected in accordance with the sampling theorem ($\delta x = 4\ \mu m$), there is a significant positive bias in the computed transform. This is the result of a phenomenon known as "aliasing", whereby when a function being sampled contains frequencies greater than the Nyquist frequency—which is the case here—these frequencies can contribute to the frequencies below the Nyquist frequency. Thus ideally a value should be selected for δx corresponding to a frequency above which there is only a small amplitude rather than the maximum frequency of interest.

Aliasing will be discussed in more detail in Chapter 8 in connection with the measurement of the Wiener spectrum of noise. For typical line spread functions there is no firm rule, but as a guide it has been suggested that the absolute error in the computed MTF will be less than 0·005 if the sampling interval is less than 25% of the half-width at half-height of the line spread function[21]. In our example the half-width at half-height is approximately $4\ \mu m$, so the sampling interval should be less than $1\ \mu m$, and this seems to be confirmed by the results of Fig. 8.

6.2 Input-output Relationships for Linear Stationary Systems

Basic Theory

A system may be defined as that which produces a set of output functions from a set of input functions. Physically the system may be an electrical circuit, in which case the input and output are time-varying voltages or currents; it may be an incoherent optical system with spatially-varying intensities as input and output; or it may be a photographic process with varying exposure as the input and, say, density as the output. Provided that certain assumptions are made about each of these systems, their input-output relationships can be analysed in a similar manner. The fact that the inputs and outputs are one-dimensional for electrical systems (functions of time) and two-dimensional for optical and photographic systems (functions of space) is of little importance. The method of analysis of electronic and optical systems are in fact so similar that Elias[6] described how he was looking forward to the

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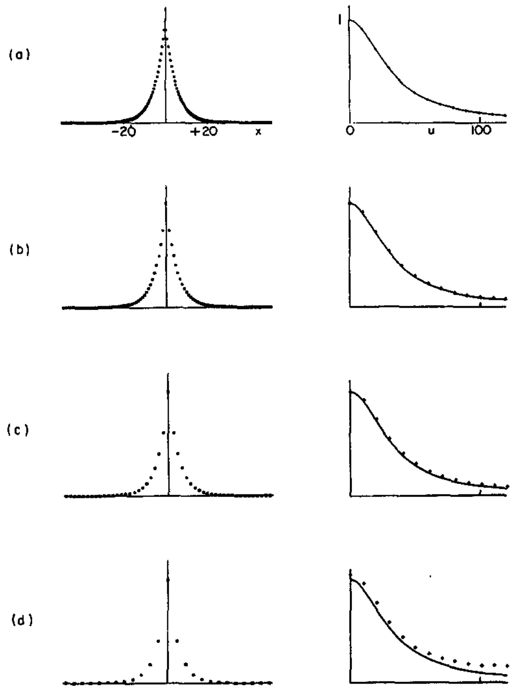

FIG. 8. The effect of sampling interval on computed FTs (see text for details).

first design for a camera lens featuring independent bass and treble control knobs!

A system can be represented by an operator S( ), which acts on input functions to produce output functions. If $f(x,y)$ represents the input and $g(x,y)$ represents the output, then

$$g(x,y) = S\{f(x,y)\}.$$

This relationship between input and output is shown schematically in Fig. 9(a). To develop the relationship further we must restrict the nature of the system.

In this chapter we shall deal only with *linear* systems. The assumption of linearity is physically realistic for many practical systems, and leads to simple input-output relationships. However it should be noted that the photographic process behaves as a linear system only under special conditions, and is non-linear in the general case, as will be discussed in detail in the next chapter.

A system is linear if for all inputs $f_1(x,y)$ and $f_2(x,y)$ and all constants a and b:

$$S\{af_1(x,y) + bf_2(x,y)\} = a\,S\{f_1(x,y)\} + b\,S\{f_2(x,y)\}. \tag{20}$$

Basically, linearity means that if the input is broken down into an additive combination of elementary inputs, each of which gives a known output, then

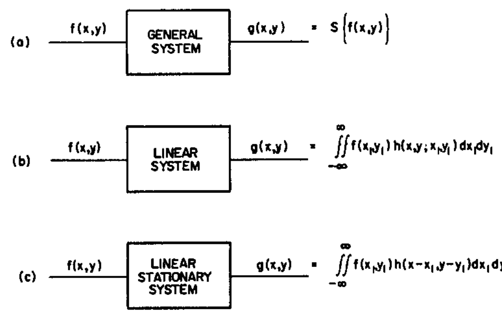

FIG. 9. Schematic representations of: (a) a general system; (b) a linear system; (c) a linear and stationary system.

the total output is found simply by adding the weighted values of the known outputs.

Using the sifting property of the delta function, as in equation (8), any input may be considered to be a linear combination of weighted and displaced delta functions:

$$f(x,y) = \iint_{-\infty}^{+\infty} f(x_1, y_1)\,\delta(x - x_1)\,\delta(y - y_1)\,dx_1dy_1$$

The output of the system is defined by

$$g(x,y) = S\left\{\iint_{-\infty}^{+\infty} f(x_1, y_1)\,\delta(x - x_1)\,\delta(y - y_1)\,dx_1dy_1\right\}.$$

If $f(x_1, y_1)$ is regarded as a weighting function applied to the delta functions, we may use the linearity property to bring the operator within the integral:

$$g(x, y) = \iint_{-\infty}^{+\infty} f(x_1, y_1)\,S\{\delta(x - x_1)\delta(y - y_1)\}\,dx_1\,dy_1.$$

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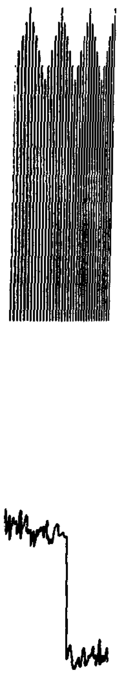

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The line spread function is usually obtained by scanning the image of an edge trace which is converted from density or transmittance to effective exposure using the macroscopic response curve. Differentiation then gives the line spread function, and the whole scheme is illustrated in Fig. 12. It has been shown to be possible to use a relatively simple sum-and-difference calculation[39] to get from the line spread function to the square-wave or sine-wave response. However, as demonstrated in Chapter 6, Fourier transformation is a simple operation if a computer is available, and one of the advantages of the edge-trace method is that it is readily adaptable to digital recording and data processing.

The preparation of suitable test charts presents little difficulty since edges are commonly occurring objects, and a razor blade edge held in contact with

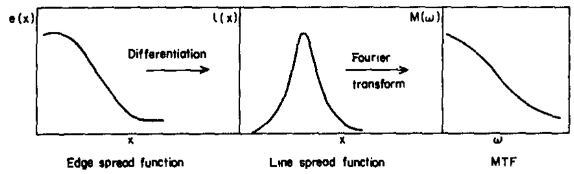

FIG. 12. Derivation of the MTF from the edge response curve.

the film may be adequate. It is more difficult to obtain low contrast edges, and special types of edge may have to be prepared if a finite transmittance is required on both sides of the edge. The main problem in the analysis of edge traces is due to the influence of image noise, as we shall see shortly.

A block diagram of the computational procedure of one particular automatic method[40,41] is shown in Fig. 13. The stages are as follows:

(1) The microdensitometer edge data is converted from arbitrary units to transmittance units, and convoluted with a microdensitometer correction function. This is more accurate than correction after the non-linear transfer of stage (2).
(2) The corrected transmittance distribution is converted to effective exposure using the macroscopic transmittance—exposure curve. A polynomial least-squares fit to this curve may be useful for implementing this stage on a computer[40], but some care has to be taken when using such techniques since errors may be introduced if large portions of the curve are fitted in this way.
(3) The data is smoothed and differentiated in a single step by convolution with a suitable function[41]. If $e(x)$ represents the effective noisy exposure edge, $e_1(x)$ the smoothed edge, and $f(x)$ the smoothing function, there will be a convolution according to

$$e_1(x) = e(x) \circledast f(x).$$

William F. Schreiber

08/709,487

Fundamentals of Electronic Imaging Systems

Some Aspects of Image Processing

Second Enlarged Edition
With 148 Figures

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Professor William F. Schreiber, Ph. D.

Massachusetts Institute of Technology,
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in terms of some known colors. In other words, only the *appearance* of the primaries (to the standard observer) affects how they mix. This is very much different from subtractive mixtures, in which colors that look alike may produce radically different results when used, for example, as pigments.

In order to give the CIE primaries more meaning, it is necessary to be able to calculate the tristimulus values of arbitrary colors in terms thereof. To do this, we must know the tristimulus values of the spectral primaries in terms of the CIE primaries. The derivation just given is not sufficient to do that, since we have so far only specified the chromaticity of the new primaries and have said nothing about their magnitude. This last point can be settled experimentally, of course, by normalizing the CIE primaries with respect to reference white. However, the transformation can also be done theoretically by the method of Wintringham, showing that if R, G, B are tristimulus values with respect to the previously used spectral primaries, and if X, Y, Z are tristimulus values with respect to the CIE primaries, then

$$X = 2.769R + 1.752G + 1.130B$$
$$Y = 1.000R + 4.591G + 0.060B$$
$$Z = 0.000R + 0.057G + 5.593B\ .$$

In particular, if this transformation is applied to the tristimulus values of unit energy spectral colors [$R(\lambda)$, $G(\lambda)$, and $B(\lambda)$ of Fig. 7.1], then we obtain the necessary data to calculate the tristimulus values of *any* color light in terms of the CIE primaries. These curves are usually labelled $\bar{x}$, $\bar{y}$, and $\bar{z}$ and are shown in Fig. 7.6.

In actual use, for any physical color specified by its spectrophotometric curve $E(\lambda)$, we find

$$X_E = \int \bar{x}(\lambda)E(\lambda)d\lambda$$

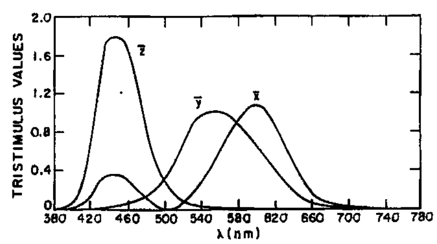

Fig. 7.6. Tristimulus values of the pure spectral colors. Like Fig. 7.1 except with respect to the CIE nonphysical primaries. White reference is still Illuminant E

7.4.3 CIE $L^*a^*b^*$ Space

This is a closed-form approximation to the empirical Munsell space and is the most uniform space in common use. It also has provision for a variable white reference, brighter than any observed color, the assumption being made that the observer adapts completely to the reference, so that the corresponding tristimulus values can simply be linearly scaled. (Note that $L^*a^*b^*$ coordinates, unlike $L^*u^*v^*$, are nonlinear, and therefore do not represent amounts of primaries.) The color-distance metric, ΔE, is the most accurate simple such metric in common use.

$$L^* = 116\left(\frac{Y}{Y_0}\right)^{1/3} - 16 \quad (.01 \le Y \le 1)$$

$$a^* = 500\left[\left(\frac{X}{X_0}\right)^{1/3} - \left(\frac{Y}{Y_0}\right)^{1/3}\right]$$

$$b^* = 200\left[\left(\frac{Y}{Y_0}\right)^{1/3} - \left(\frac{Z}{Z_0}\right)^{1/3}\right]$$

$$\Delta E = (\Delta a^{*2} + \Delta b^{*2} + \Delta L^{*2})^{1/2} .$$

7.5 Additive Color Reproduction

Colorimetry provides a straightforward way to design a color image reproduction system, such as color TV, where additive color synthesis is used. For example, three component images might be displayed on three white CRTs and projected in register, through three filters, onto a white screen.[8] The filtered white lights are the display primaries of the system. If the intensities of the CRTs, at corresponding points, were proportional to the tristimulus values of the corresponding point in the original scene with respect to the three primary colors (the projection filters), then an exact colorimetric match would be achieved within the gamut of the primaries. Attempts to produce colors outside of the gamut would result in negative intensity. In practice, with present-day filters or red, green, and blue phosphors, highly satisfactory color rendition is possible.

To obtain the tristimulus values needed to display the separate images, the spectral intensity, $E(\lambda)$, of each point of the scene must be multiplied by $R(\lambda)$, $G(\lambda)$, and $B(\lambda)$, the tristimulus values of the spectrum lights with respect to the display primaries, and then integrated over the visible spectrum as discussed above. In order to implement these mathematical operations with simple filters, we could divide the incoming light into three images by means of beam splitters,

[8] TV tubes having closely spaced dots or lines of three colored phosphors also effect additive synthesis when viewed from a distance at which the component images merge. Another example is the projection of red, green, and blue images in rapid sequence.

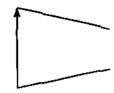

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EXHIBIT B
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Framework for an Image Sharpness Management System

08/709,487

Lindsay MacDonald
Colour & Imaging Institute, University of Derby, United Kingdom

Abstract

A new framework for image sharpness management is proposed, analogous to the existing framework for color management systems. Knowledge of both the human visual contrast sensitivity function (CSF) and of device spatial resolution, characterized via the modulation transfer function (MTF), can be used to determine the optimum correction to be made to the sharpness of an image for specified viewing conditions, via parametric image processing techniques. The proposed framework includes profiles for spatial input and output device characteristics, connected via a profile connection space with the facility for the operator to specify a sharpness rendering intent.

Automation of Color Image Processing

The development of color management systems during the past decade has been driven by the following factors:

Cost and productivity – When image production systems need to be automated for commercial production of images of acceptable quality, it is not cost-effective to employ a skilled person to make visual judgements for each image. Batch processing and lower skill levels are essential;

Device independence – It should be possible to reproduce an image on multiple devices with the same color appearance, i.e. independent of the device or process characteristics;

Inter-operability – It should be possible to preserve the color appearance of an image when transferring it from one system to another. The destination system should be able to interpret the colors in the image to produce an equivalent visual representation of the source.

The same arguments justified the development of negative film printing systems in the past. More recently they have applied to desktop publishing in the graphic arts, and now they are driving the development of industry standards in digital video editing and broadcasting.

All the attention so far has been on color and tonal fidelity, and standards such as those of the International Color Consortium (ICC) reflect this focus.[1] Yet color and tone are not the only visual dimensions of images. Sharpness and noise are arguably of equal importance in determining the overall appearance of an image, but these have received little attention from the color imaging community. In this paper is proposed a new framework for image sharpness, which the author believes will enable new levels of image quality to be achieved economically through embedded processing within imaging systems, with a minimum of operator intervention.

Visual Contrast Sensitivity

The ability of the human eye to resolve fine spatial detail is expressed by its spatial *contrast sensitivity function* (CSF), or relative visual response as a function of ~~spatial frequency~~. Spatial contrast sensitivity depends on the scene luminance level, as shown in Figure 1 in which the retinal illuminance varies from 0.0009 trolands up to 900 trolands. The greatest sensitivity is achieved at about 8 cycles per degree, i.e. about 1 line pair per mm at 48 cm viewing distance. At lower levels of illumination (mesopic and scotopic) the sensitivity is reduced and peaks at a lower spatial frequency, becoming a low-pass instead of band-pass characteristic. The drop in photopic contrast sensitivity at low spatial frequencies can be explained by the field size exceeding the effective diameter of the center-surround receptive fields produced by the post-receptoral neural interconnections in the retina and visual cortex.[2]

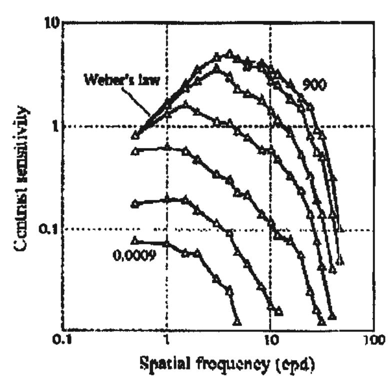

Figure 1 Contrast sensitivity as a function of spatial frequency, with retinal illuminance as a parameter (Reproduced by courtesy of Brian Wandell)

Within the retina there can be identified at least four separate receptive fields, each of which operates at a different spatial scale. These fields peak at spatial frequencies of about 1, 5, 9 and 12 cycles per degree (cpd), and combine to produce the composite contrast sensitivity function.[3] The lower two have relatively sustained temporal properties, whereas the higher two are more transient. The spatial receptive field of each region can be approximated by a difference of two Gaussian (DOG) functions.[4] Recent developments in color appearance models make use of multi-resolution processing – simulating the neural channels – filtering the image array generated by the photoreceptors into a pyramid of image components at different spatial frequencies, resulting in better predictions of induction, crispening and spreading effects than conventional models.[5]

Typical spatial CSFs for luminance contrast (black-white) and chromatic contrast (red-green and yellow-blue at constant luminance) are shown in Figure 2. The luminance CSF is band-pass in nature, approaching zero at both very low (less than 0.1 cpd) and very high (greater than 50 cpd) spatial frequencies. The chrominance CSFs have a low-pass shape, with a lower peak sensitivity and lower cut-off frequencies than the luminance CSF.[6] Only spatial patterns with frequencies less than about 5 cpd can excite the L-M (red-green') opponent neural pathway, and only spatial patterns with frequencies less than about 2 cpd can excite the S-(L+M) (blue-yellow') opponent neural pathway. [7]

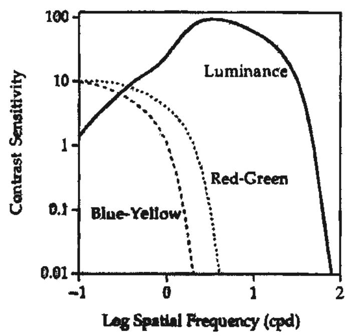

Figure 2 Contrast sensitivity functions for spatial luminance and chromatic contrast. (Reproduced by courtesy of Mark Fairchild)

Spatial interactions within the visual system lead to interactions between perceived color and sharpness. Cornsweet demonstrated that perceived brightness depends not only on the intensity of an object or region in the visual field, but also on its edge contour. By applying a localized change in intensity on either side of the edge of a region of a spinning disc, he created the illusion of a region of different lightness.[8] The effect works best when the region subtends a large visual angle (2 degrees or more), so that its spatial frequency at a normal viewing distance is low (less than 1 cpd) and hence the visual CSF is low. The effect can only be seen in luminance, not chrominance, because the opponent color channels are band-pass and do not have lower response at low spatial frequencies.

Studies have shown that spatial frequency has a strong effect on chromatic induction.[9] Changes in the spatial frequency of test stimuli caused a transition in observers' colour perception from contrast (below 1 cpd) to assimilation (at 9 cpd). In general, the spatial structure of an image must be taken into account in formulating a complete model of color appearance.[10]

Device Resolution

All imaging devices have spatial structures in their construction and therefore impose spatial characteristics on the images they capture or produce. These characteristics, combined with the point-spread effects of optical or electrical transfer functions, result in limitations on the spatial frequencies the devices can produce. One must distinguish, moreover, between *addressed resolution* and *achieved resolution*. The former is the limit of control available from the host computer, usually represented by the addressable pixel array in an image, whereas the latter is determined by the actual spatial frequency response of the device or medium, characterized in terms of its *modulation transfer function* (MTF). Achieved resolution can be defined by the spatial frequency at which the MTF has decreased to a given percentage of its peak value, typically 10%.

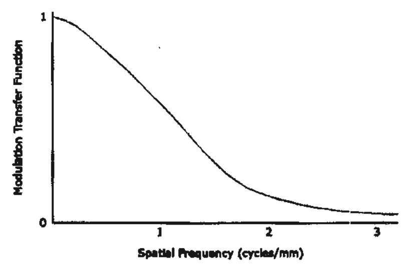

Figure 3 Modulation transfer function (MTF) of a typical desktop CRT display

MTF is a measure of how well an imaging device or system can reproduce a scene. Ideally the MTF should be high over the full range of frequencies of interest, which for human viewing means the full range of spatial frequencies to which the human visual system is sensitive under the prevailing viewing conditions. The MTF of most imaging systems is limited by the display device.[11] For cathode ray tube (CRT) displays, the MTF is determined primarily by the point-spread function of the electron beam and secondarily by bandwidth limitations in the electronics,[12]

of the overall contribution of all discernible spatial frequencies, and hence the contrast sensitivity function (CSF) of the eye must be taken into account in formulating a useful metric for image sharpness.[13,14,15]

Figure 4 MTF characteristics of a 35mm film scanner for the fast and slow scanning directions (Reproduced by courtesy of Ralph Jacobson).

Different techniques may be used to determine the MTF characteristics of imaging devices. For film scanners and digital cameras, typical targets are sine wave charts with patches of different frequencies and specified modulation depth. Other techniques involve the scanning and Fourier transform of photographic grain noise patterns, and the analysis of the spatial frequency response of slanted edges.[16] Line-array scanners may exhibit different MTF characteristics in the two scanning directions, parallel and perpendicular to the CCD array, as shown in Figure 4. For displays a modulated pattern may be generated, and photographed on film or via a digital camera for analysis. The resulting system MTF is the cascaded combination of both camera and display characteristics, from which the display's MTF can be extracted.[17] Printing devices and processes are characterized by their dot size and/or halftone frequency, and can be measured via micro-line resolution targets or via photographic analysis, as for displays.[18]

Dealing with Sharpness in Image Reproduction

Sharpness can be regarded as a separate dimension of image appearance, independent of lightness, hue and chroma, as shown in Figure 5. When an image is sharp, more detail can be discerned – sharp edges permit the observer to discriminate objects more clearly, and sharp details permit the observer to recognize surface characteristics more accurately. Sharpness is lost in image capture through optical and physical limitations of the scanner or digital camera, such as aperture size, lens aberration and sampling interval. Sharpness is also lost through subsequent digital quantisation, compression and transformations such as geometric manipulation and color space conversion. Finally sharpness is lost through rendering of an image for output, for example in halftones or error diffusion for printing, or in the spatial microstructure of a display or film recorder.

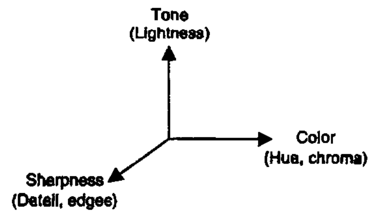

Figure 5 Three dimensions of image reproduction

Substantial improvements in image appearance can be achieved through applying the optimum amount of sharpening. For some types of image, sharpness can be argued to be a more important factor than color, in the sense that degradation of sharpness will make the image less acceptable than degradation of color. Yet sharpness is frequently overlooked as a factor in image reproduction, the assumption being that either it has been dealt with elsewhere in the system or that it is outside the control of the processing software. Certainly sharpness has received very much less attention than color for image enhancement and/or correction.

It would be possible, of course, for a user of an image reproduction system to adjust the degree of sharpness of individual images, using the editing tools provided in Adobe *Photoshop* or in other similar software. But for reasons of cost and productivity it would be highly desirable to be able to offer facilities within the computer operating system to support the semi-automated sharpness enhancement of images from any source device *en route* to any destination device. The key benefits to the customer of this approach would be as follows:

1. Enhance the visual quality of images derived from consumer digital input devices, such as digital cameras and desktop photo scanners, and also images obtained from image libraries or the Internet;
2. Support automated processing in workflows involving large numbers of images for print and multimedia applications;
3. Obtain image reproductions, in display or print, that are optimized for the viewing conditions in which they will be viewed.

Many image processing techniques, such as 'edge crispening' convolution filters and Fourier domain filters, exist for sharpness enhancement.[19] Image reproduction

systems, such as television, have built-in sharpness enhancement to compensate for MTF losses in both source (camera) and destination (display) devices. In the graphic arts industry the unsharp mask (USM) filter is well known as a means of applying sharpness enhancement to images and has been widely implemented in both scanner hardware and workstation software.[20] Most of these techniques have been developed empirically, however, with little or no sound theoretical basis, and they are usually applied to all device color channels (RGB or CMYK) simultaneously.

Because the achromatic channel of vision carries most of the sharpness information, it follows for an image encoded into separate luminance and chrominance components that the chrominance data can be sampled at lower spatial frequency without significant loss of image quality. This principle is used in the reduction of bandwidth requirements for color television broadcast systems (NTSC and PAL) and in color image compression algorithms (JPEG and MPEG).[21]

The enhancement of image sharpness should therefore be performed optimally by processing an image separately in its luminance and chrominance components, or to a good approximation by processing the luminance channel alone. This suggests that an efficient implementation of image sharpening could be achieved by processing only the lightness (L*) component of an image encoded in a uniform color space such as CIELAB or CIELUV. The sharpening filter should be designed to enhance the appropriate spatial frequencies of the image in two ways: (1) those lost because of device MTF characteristics; and (2) those required to render the image most effectively for the needs of the human visual system under the viewing conditions in which it will be seen.

Framework for Image Sharpness Management

A framework for an image sharpness management system is proposed, as shown in Figure 6, analogous to the ICC framework for color management.[1] This goes beyond previously proposed systems[22] by defining a generic structure for separately characterizing the spatial characteristics of input and output imaging devices, and a standard connection mechanism for image processing.

The spatial characteristics of the input device, including MTF and enlargement factor, would be stored in an *input profile*. These data would be used by the input transform to convert the input image into a device independent form, representing the appearance of the ideal image when viewed by an observer of standard visual acuity in a standard viewing environment at a standard viewing distance. The image in this *profile connection space* (PCS) would be perfectly corrected for the losses of sharpness caused by the optics and sampling process of the input device. In similar fashion, the spatial characteristics of the output device, including MTF and enlargement factor, would be stored in an *output profile*. These would be used by the output transform to convert the image from the PCS into the output format. This transform could optionally include characteristics of the environment under which the final image should be viewed, such as luminance level and viewing distance.

The operator of the system would also have the possibility of making editorial corrections to an image, such as sharpness enhancement, either by processing the image data directly in the profile connection space, or by adjusting the parameters of the input or output profiles. As with the practical implementation of color management systems, the source and destination profiles could be compounded into a single transform for more efficient processing of images.[23]

The concept of *rendering intent* can also be applied to sharpness. Plausible rendering intents could include:

- Maximize sharpness
- Enhance edges
- Minimize noise (grain)
- Facsimile of original
- Soft focus
- Pleasing portrait

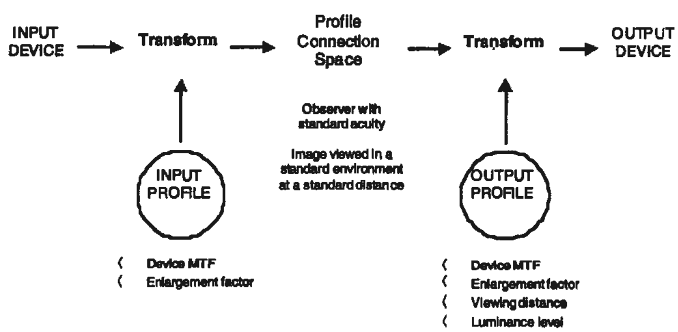

Figure 6 Framework for an image sharpness management system

More sophisticated rendering intents may apply differing degrees of sharpness enhancement in different colour components or different regions of an image. Studies of photographic color prints have shown that the subjective preference for sharpness can be enhanced through suitable filtering of the green component of the image, thereby smoothing the magenta dye component of the print.[24] A critical case is the rendering of facial portraits, in which the hair, eyebrows and lips may benefit from increased sharpness whereas skin tones may benefit from softening (reduced sharpness) in order to disguise skin pores and blemishes.[25] Such rendering may be achieved through the use of a colour-selective sharpening/softening algorithm.

The nature of the input and output media and the user's viewing task (scanning and fixation patterns, attention span, motivation, etc.) can also affect the appearance of sharpness in images. A more complete framework would therefore include corrections for the media types and the intended viewing task, such as åt a glance', protracted examination, legibility of text, discriminability of information, conspicuity of status warnings, continuity of moving images, etc.

Conclusions

Although it is arguable that sharpness is more important than color rendering in image reproduction, sharpness has not yet been properly addressed in desktop imaging systems. Sharpness losses due to the spatial sampling characteristics of imaging devices should be compensated to achieve more pleasing reproduction of images. Because human vision has much higher contrast sensitivity for achromatic luminance information, processing efficiency could be achieved by sharpening images in the luminance component alone. Sharpness management systems with architectures analogous to existing color management systems should in future fulfil this need. One way to achieve this would be to extend the ICC framework to include the additional spatial data in device profile definitions and to add sharpness enhancement to CMM processing.

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X. ATTACHMENTS

The following references as cited above are attached with their relevant pages:

1. Hunt: Title page, Copyright page, and pages 393-396;
2. Dainty and Shaw: Title page, copyright page, and pages 204-206 and 245;
3. Schreiber: Title page, copyright page, and pages 177 and 182; and
4. MacDonald: Pages 75-79.

Respectfully submitted,

Tel: 781-386-6474
Fax: 781-386-6435

Robert J. Decker
Attorney for the Applicants
Registration No. 44,056

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All participants (applicant, applicant's representative, PTO personnel):

(1) Dr. Bror Hultgren (Inventor) (3) Robert J. Decker (Attorney)

(2) Dr. Jay Thornton (Inventor) (4) Daniel G. Mariam (5) Andrew Johns (Primary Examiner)

Date of Interview 1/20/00

Type: ☒ Telephonic ☐ Personal (copy is given to ☐ applicant ☐ applicant's representative).

Exhibit shown or demonstration conducted: ☐ Yes ☐ No If yes, brief description:

Agreement ☒ was reached. ☐ was not reached.

Claim(s) discussed: 1, 9, 16 and 24

Identification of prior art discussed: Stokes and Laumeyer, et al.

Description of the general nature of what was agreed to if an agreement was reached, or any other comments: Discussed issues pertinent to independent claims 1, 9, 16 and 24. Two of the inventors indicated above have explained the difference between the prior art and the claimed invention. Particularly, Dr. Hultgren described the claimed invention "second data being a device dependent transformation of spatial information content of the image." in detail corresponding to the prior art. Applicants' argument and explanation is persuasive, and thus the final rejection is withdrawn.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

1. ☒ It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a response to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

2. ☐ Since the Examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the interview unless box 1 above is also checked.

Examiner Note: You must sign this form unless it is an attachment to another form.

FORM PTOL-413 (REV.1-96)

ANDREW W. JOHNS
PRIMARY EXAMINER

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
08/709,487	09/06/96	HULTGREN	B	8166(RAS)

020349 LM32/0121
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

EXAMINER	
MARIAM,D	

ART UNIT	PAPER NUMBER
2721	

DATE MAILED: 01/21/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)
*U.S. GPO: 1997-422-199/80031

1- File Copy

Notice of Allowability	Application No. 08/709,487	Applicant(s) HULTGREN ET AL.
	Examiner DANIEL G MARIAM	Art Unit 2721

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--
All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance and Issue Fee Due or other appropriate communication will be mailed in due course.

1. ☒ This communication is responsive to *an amendment filed on 12-30-99 & a telephone interview dated 1-20-00*.
2. ☒ The allowed claim(s) is/are *1-33*.
3. ☐ The drawings filed on _____ are acceptable.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
   a) ☐ All b) ☐ Some* c) ☐ None of the CERTIFIED copies of the priority documents have been
   1. ☐ received.
   2. ☐ received in Application No. (Series Code / Serial Number). _____ .
   3. ☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
   * Certified copies not received: _____.
5. ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

A SHORTENED STATUTORY PERIOD FOR REPLY to comply with the requirements noted below is set to EXPIRE THREE MONTHS FROM THE "DATE MAILED" of this Office Action. Failure to timely comply will result in ABANDONMENT of this application. Extensions of time may be available under the provisions of 37 CFR 1.136(a).

6. ☐ Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.

7. ☒ Applicant MUST submit NEW FORMAL DRAWINGS
   (a) ☐ because the originally filed drawings were declared by applicant to be informal.
   (b) ☒ including changes required by the Notice of Draftsperson's Patent Drawing Review(PTO-948) attached
   1) ☐ hereto or 2) ☒ to Paper No. *4*.
   (c) ☐ including changes required by the proposed drawing correction filed _____, which has been approved by the examiner.
   (d) ☐ including changes required by the attached Examiner's Amendment / Comment.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the reverse side of the drawings. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

8. ☐ Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Any reply to this letter should include, in the upper right hand corner, the APPLICATION NUMBER (SERIES CODE / SERIAL NUMBER). If applicant has received a Notice of Allowance and Issue Fee Due, the ISSUE BATCH NUMBER and DATE of the NOTICE OF ALLOWANCE should also be included.

Attachment(s)

1☐ Notice of References Cited (PTO-892)
3☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
5☐ Information Disclosure Statements (PTO-1449), Paper No. ____.
7☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
2☐ Notice of Informal Patent Application (PTO-152)
4☒ Interview Summary (PTO-413), Paper No.____ .
6☐ Examiner's Amendment/Comment
8☒ Examiner's Statement of Reasons for Allowance
9☐ Other

U.S. Patent and Trademark Office
PTO-37 (Rev. 3-98) **Notice of Allowability** Part of Paper No. 19 .

Allowable Subject Matter

1. Claims 1-33 are allowed.

2. The following is an examiner's statement of reasons for allowance: while describing a device dependent transformation of color information content of the image to a device independent color space is well known in a color management system as evidenced by the primary reference to Stokes, none of the prior art, however, teach or suggest a device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image comprising: a data for describing a device dependent transformation of spatial information content of the image in a device independent color space. It is for this reason and in combination with all the other limitations in the claims, that independent claims 1, 9, 16 and 24 are allowable over the prior art of record. Since claims 2-8, 10-15, 17-23 and 25-33 further restrict these claims they are allowable also.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL G MARIAM whose telephone number is 703-305-4010. The examiner can normally be reached on M-F (7:00-4:30) FIRST FRIDAY OFF.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, LEO BOUDREAU can be reached on 703-305-4607. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-5397 for regular communications and 703-308-5397 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-3900.

Daniel G. Mariam
Art Unit: 2721
Examiner

January 20, 2000

ANDREW W. JOHNS
PRIMARY EXAMINER

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

020349 LM32/0121
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/709,487	09/06/96	033	MARIAM, D	2721	01/21/00

First Named Applicant: HULTGREN, 35 USC 154(b) term ext. = 0 Days.

TITLE OF INVENTION: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 8166(RAS)	382-276.000	H26	UTILITY	NO	$1210.00	04/21/00

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED.

THE ISSUE FEE MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED.

HOW TO RESPOND TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is changed, pay twice the amount of the FEE DUE shown above and notify the Patent and Trademark Office of the change in status, or
B. If the status is the same, pay the FEE DUE shown above.

If the SMALL ENTITY is shown as NO:

A. Pay FEE DUE shown above, or
B. File verified statement of Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.

II. Part B-Issue Fee Transmittal should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by charge to deposit account, Part B Issue Fee Transmittal should be completed and returned. If you are charging the ISSUE FEE to your deposit account, section "4b" of Part B-Issue Fee Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give application number and batch number. Please direct all communications prior to issuance to Box ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PATENT AND TRADEMARK OFFICE COPY

PTOL-85 (REV. 10-96) Approved for use through 06/30/99. (0651-0033)

*U.S. GPO: 1996-437-639/80023

EXHIBIT B
PAGE 181

PART B—ISSUE FEE TRANSMITTAL

Complete and mail this form, together with applicable fees, to: Box ISSUE FEE
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Washington, D.C. 20231

MAILING INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE. Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Issue Fee Receipt, the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)

020349 LM32/0121
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

OIPE JOBY FEB 2 8 2000 PATENT & TRADEMARK OFFICE

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Robert J. Decker (Depositor's name)
[signature] (Signature)
February 25, 2000 (Date)

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/709,487	09/06/96	033	MARIAM, D	2721	01/21/00

First Named Applicant: HULTGREN, 35 USC 154(b) term ext. = 0 Days.

TITLE OF INVENTION: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 8166(RAS)	382-276.000	H26	UTILITY	NO	$1210.00	04/21/00

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). Use of PTO form(s) and Customer Number are recommended, but not required.

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47) attached.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Robert J. Decker
2 ____________
3 ____________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)
PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE
POLAROID CORPORATION

(B) RESIDENCE: (CITY & STATE OR COUNTRY)
784 Memorial Drive, Cambridge, MA USA

Please check the appropriate assignee category indicated below (will not be printed on the patent)
☐ individual ☐ corporation or other private group entity ☐ government

4a. The following fees are enclosed (make check payable to Commissioner of Patents and Trademarks):
☒ Issue Fee
☒ Advance Order - # of Copies 10

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DEPOSIT ACCOUNT NUMBER 16-2195
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☒ Advance Order - # of Copies 10

The COMMISSIONER OF PATENTS AND TRADEMARKS IS requested to apply the Issue Fee to the application identified above.

(Authorized Signature) [signature] 44,056 (Date) 2/25/00

02/29/2000 KZEWDIE1 00000016 08709487
01 FC:142 1210.00 OP
02 FC:561 30.00 OP

NOTE: The Issue Fee will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the Patent and Trademark Office.

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PTOL-85B (REV.10-96) Approved for use through 06/30/99. OMB 0651-0033

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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020349 LM32/0121
POLAROID CORPORATION
PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

OIPE JCG1 FEB 2 8 2000 PATENT & TRADEMARK OFFICE

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Robert J. Decker (Depositor's name)
[signature] (Signature)
February 25, 2000 (Date)

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/709,487	09/06/96	033	MARIAM, D	2721	01/21/00

rst Named Applicant: HULTGREN, 35 USC 154(b) term ext. = 0 Days.

E OF ENTION: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 8166(RAS)	382-276.000	H26	UTILITY	NO	$1210.00	04/21/00

Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). Use of PTO form(s) and Customer Number are recommended, but not required.

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☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47) attached.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Robert J. Decker
2 ________
3 ________

ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)
PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE
POLAROID CORPORATION

(B) RESIDENCE: (CITY & STATE OR COUNTRY)
784 Memorial Drive, Cambridge, MA USA

Please check the appropriate assignee category indicated below (will not be printed on the patent)
☐ individual ☐ corporation or other private group entity ☐ government

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uthorized Signature) [signature] 44,056 (Date) 2/25/00

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Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

#30 2/24

Docket No. 8166/RJD PATENT

OIPE JC81 FEB 28 2000 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit:	2721	Batch No.:	H26
Application of:	Hultgren et al.	Examiner:	D. Mariam
Serial No.:	08/709,487	Filed:	September 6, 1996
For:	DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM		

BOX ISSUE FEE
Assistant Commissioner for Patents
Washington, D.C. 20231

Attention: Official Draftsperson

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Date: February 25, 2000

Robert J. Decker
Registration No. 44,056

SUBSTITUTE DRAWINGS UNDER RULE 1.85

Sir:

In response to the requirement in the Notice of Allowability, enclosed herewith are 3 sheets of substitute drawings (Figs 1-4) in the subject-named application to replace the corresponding sheets in accordance with the provisions of Rule 1.85. The undersigned states that each one of the sheets is a true copy of the corresponding drawings as filed, modified:

X to meet the requirements of PTO-948 dated October 26, 1996 (mailed with Paper No. 4 on December 10, 1997)

X to incorporate changes in accordance with the redline drawings filed on July 14, 1999.

Respectfully submitted,

Robert J. Decker
Attorney for the Applicant
Registration No. 44,056

Tel: 781-386-6474
Fax: 781-386-6435

\\NORFILE1\LEGAL\Patent\Cases\8166 RJD\8166 SubmitDrawings.doc

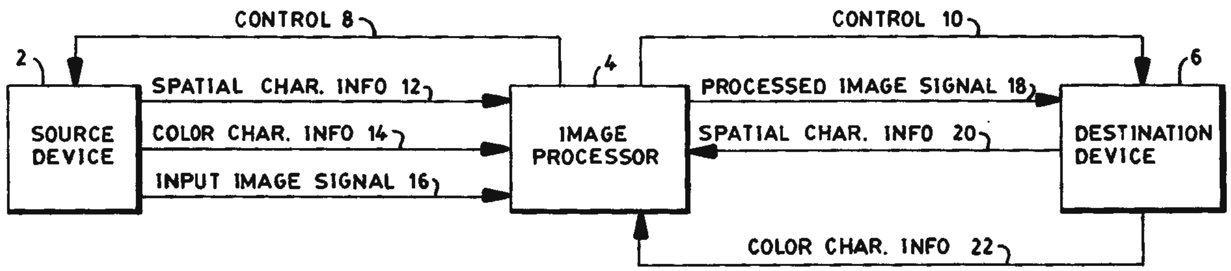

FIG. 1

8128416

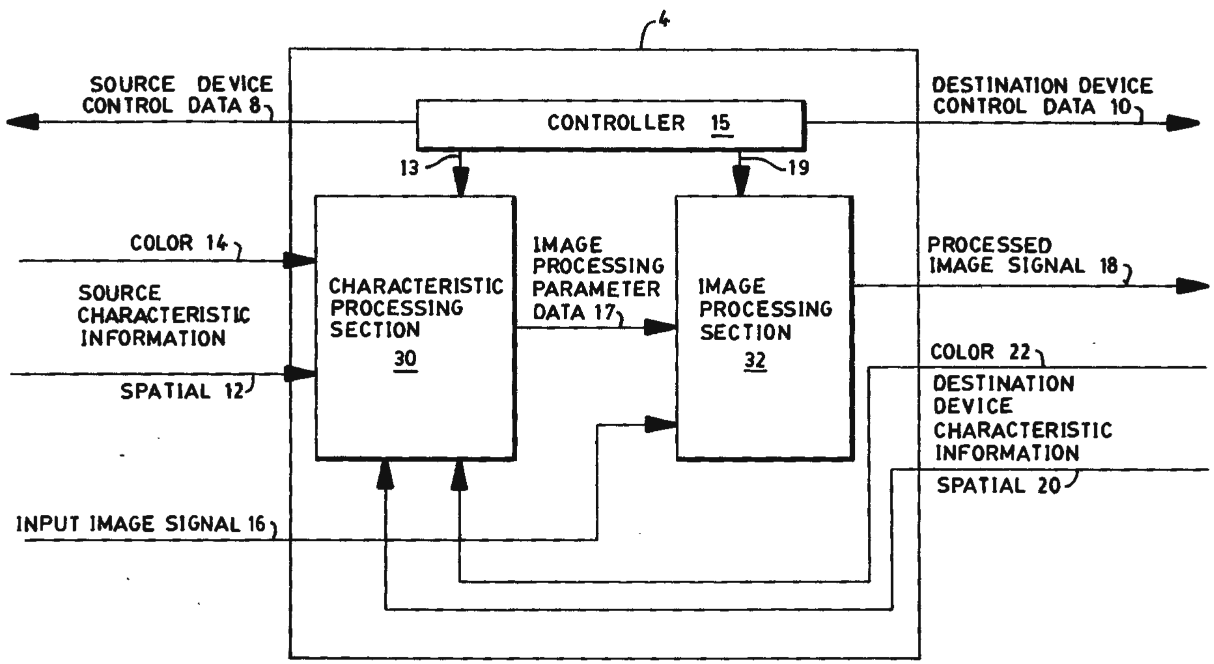
4
SOURCE DEVICE CONTROL DATA 8
CONTROLLER 15
DESTINATION DEVICE CONTROL DATA 10
13
19
COLOR 14
SOURCE CHARACTERISTIC INFORMATION
SPATIAL 12
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IMAGE PROCESSING PARAMETER DATA 17
IMAGE PROCESSING SECTION 32
PROCESSED IMAGE SIGNAL 18
COLOR 22
DESTINATION DEVICE CHARACTERISTIC INFORMATION
SPATIAL 20
INPUT IMAGE SIGNAL 16

FIG. 2

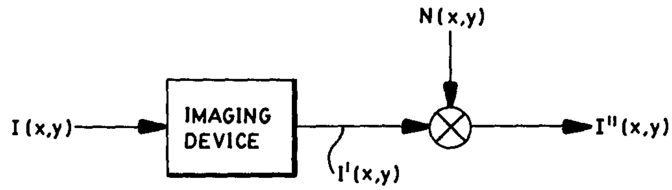
N(x,y)
I(x,y)
IMAGING DEVICE
I'(x,y)
I''(x,y)

FIG. 3

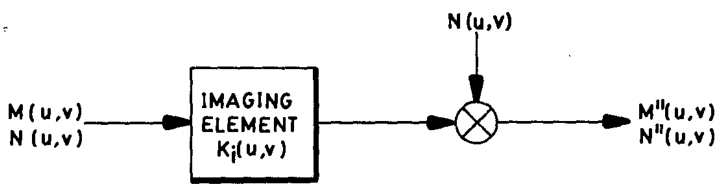
N(u,v)
M(u,v)
N(u,v)
IMAGING ELEMENT
$K_i(u,v)$
M''(u,v)
N''(u,v)

FIG. 4

#B

C-8166/RJD

FEB 28 2000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit: 2721
Application of: Hultgren et al.
Serial No.: 08/709,487
Filed: September 6, 1996
For: DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Batch No.: H26
Examiner: D. Mariam

Cambridge, Massachusetts 02139
February 25, 2000

Box Issue Fee
Assistant Commissioner for Patents
Washington, DC 20231

ISSUE FEE TRANSMITTAL (37 C.F.R. § 1.311) AND ADVANCE COPY ORDER

Dear Sir:

With respect to the above referenced application, please find enclosed Check No. 10799 in the amount of $1240 in payment of the issue fee together with an advance order for ten (10) copies of the patent to be issued.

Please charge any additional fee due, or credit any overpayment, to Deposit Account No. 16-2195. A duplicate copy of this paper is enclosed.

NOTE: SUBSTITUTE DRAWINGS BEING CONCURRENTLY FILED HEREIN.

Respectfully submitted,

Robert J. Decker
Registration No. 44,056

Tel: 617-386-6474

RJD:lmh
Enclosures: PTOL-85B, Check No. 10799, duplicate copy of paper, postcard, 4 Drawings

CERTIFICATE OF MAILING (37 C.F.R. §1.8)

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Date: February 25, 2000

Robert J. Decker
Registration No. 44,056

UNITED STATES DEP\RTMENT OF COMMERCE
Patent and T' Offica
ASSISTANT SECRETA. , ΛD COMMISSIONER
OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

CHANGE OF ADDRESS/POWER OF ATTORNEY

FILE LOCATION 9200 SERIAL NUMBER 08709487 PATENT NUMBER 6128415

THE CORRESPONDENCE ADDRESS HAS BEEN CHANGED TO CUSTOMER # 20349

THE PRACTITIONERS OF RECORD HAVE BEEN CHANGED TO CUSTOMER # 20349

THE FEE ADDRESS HAS BEEN CHANGED TO CUSTOMER # 20349

ON 05/09/03 THE ADDRESS OF RECORD FOR CUSTOMER NUMBER 20349 IS:

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PATENT DEPARTMENT
784 MEMORIAL DRIVE
CAMBRIDGE MA 02139

AND THE PRACTITIONERS OF RECORD FOR CUSTOMER NUMBER 20349 ARE:

24359 25173 25778 25937 26378 33740 34442 35344 36780 40049
40256 45934

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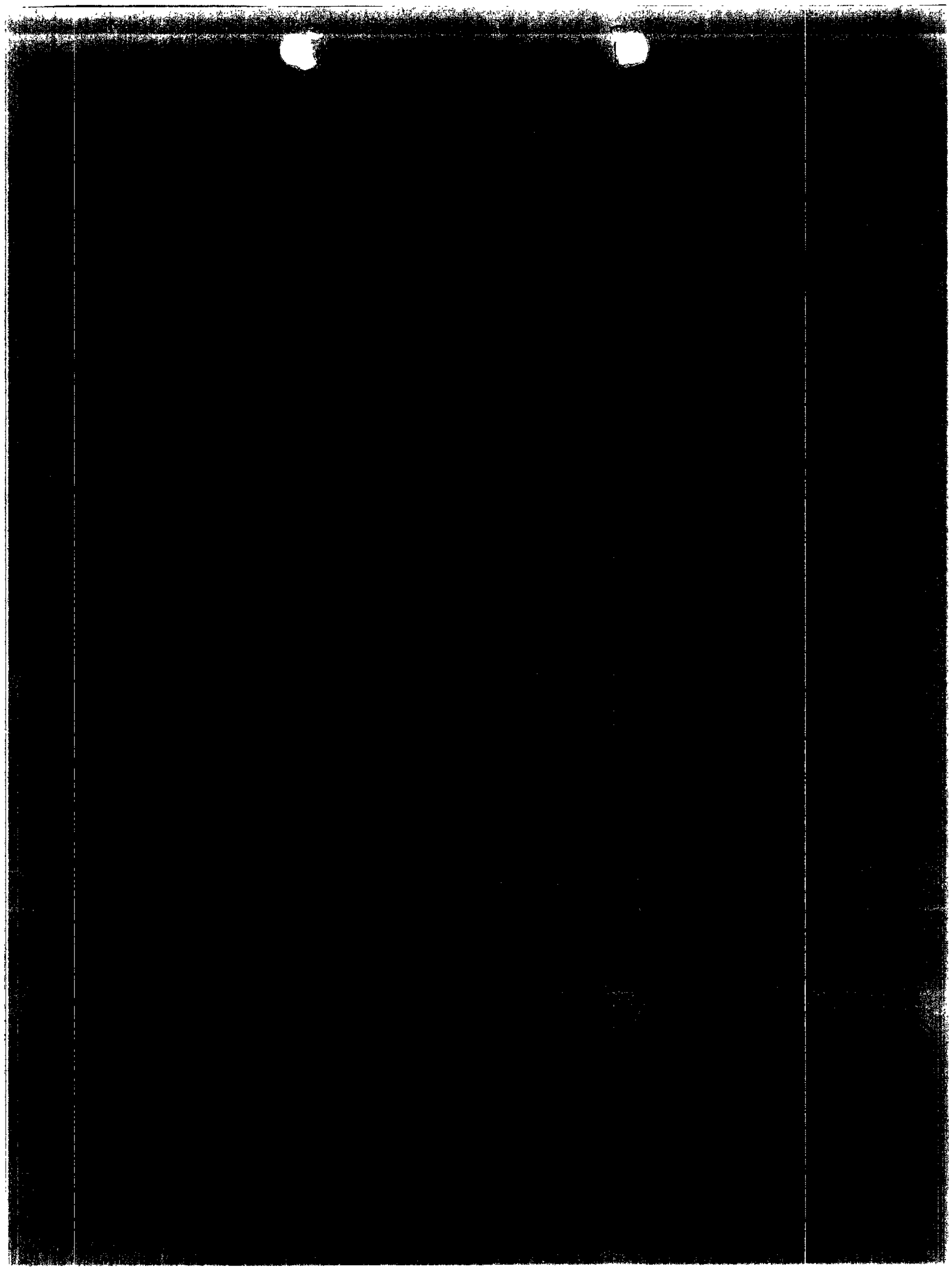
THIS FILE IS ASSIGNED TO GAU 0000.

PTO-FMD
TALBOT-1/97

```
     (FILE 'USPAT' ENTERED AT 10:38:47 ON 10 APR 1999)
L1           32 S SPATIAL  (P) DEVICE(3A)INDEPENDENT
L2            5 S L1 (P) (TRANSFORM? OR TRANSFORMATION)
L3            1 S 5379122/PN
L4            1 S L3 AND DEVICE INDEPENDENT
L5         2618 S DEVICE(3A)PROFILE#
L6           46 S L5 (P) INDEPENDENT
```

```
      (FILE 'HOME' ENTERED AT 08:35:52 ON 06 MAY 1998)

      FILE 'INSPEC, WPIDS, EUROPATFULL, USPATFULL' ENTERED AT 08:36:07 ON
      06 MAY 1998
L1          111 S DEVICE(5A)INDEPENDENT(10A)(TRANSFORM? OR TRANSFORMATION
L2           56 S L1 AND DEVICE(3A)DEPENDENT
L3           45 S L2 AND COLOR(3A)SPACE
L4           12 S L3 AND DIGIT?(3A)IMAGE#
```



PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 1995

Application or Docket Number: 08709487

CLAIMS AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE				375.00	OR		750.00
TOTAL CLAIMS	31 minus 20 =	* 11	x$11=		OR	x$22=	242
INDEPENDENT CLAIMS	4 minus 3 =	* 1	x39=		OR	x78=	78
MULTIPLE DEPENDENT CLAIM PRESENT			+125=		OR	+250=	
			TOTAL		OR	TOTAL	1070

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x39=		OR	x78=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+125=		OR	+250=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x39=		OR	x78=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+125=		OR	+250=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x39=		OR	x78=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+125=		OR	+250=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 10/95)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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Form PTO 1130
(REV 2/94)

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

PACE DATA ENTRY CODING SHEET

1ST EXAMINER	[illegible]	DATE	101596
2ND EXAMINER		DATE	

APPLICATION NUMBER	TYPE APPL	FILING DATE (MONTH DAY YEAR)	SPECIAL HANDLING	GROUP ART UNIT	CLASS	SHEETS OF DRAWING
08/709487	1	09 06 96	0	2606	382	003

TOTAL CLAIMS	INDEPENDENT CLAIMS	SMALL ENTITY?	FILING FEE	FOREIGN LICENSE	ATTORNEY DOCKET NUMBER
031	004	0	1070	√	8166(RAS)

CONTINUITY DATA

CONT CODE	STATUS CODE	PARENT APPLICATION SERIAL NUMBER	PCT APPLICATION SERIAL NUMBER	PARENT PATENT NUMBER	PARENT FILING DATE (MONTH DAY YEAR)
			PCT/ /		
			PCT/ /		
			PCT/ /		
			PCT/ /		
			PCT/ /		

PCT/FOREIGN APPLICATION DATA

FOREIGN PRIORITY CLAIMED	COUNTRY CODE	PCT/FOREIGN APPLICATION SERIAL NUMBER	FOREIGN FILING DATE (MONTH DAY YEAR)
N			

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET
(FOR USE WITH FORM PTO-875)

SERIAL NO. 709487

FILING DATE

APPLICANT(S)

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT			*		*		*	
	IND	DEP	IND	DEP	IND.	DEP.		IND.	DEP.	IND.	DEP.	IND.	DEP
1							51						
2							52						
3							53						
4							54						
5							55						
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37							87						
38							88						
39							89						
40							90						
41							91						
42							92						
43							93						
44							94						
45							95						
46							96						
47							97						
48							98						
49							99						
50							100						
TOTAL IND.							TOTAL IND.						
TOTAL DEP.							TOTAL DEP.						
TOTAL							TOTAL CLAIMS						

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ICC Profile Format Specification

Version 3.10b

October 21, 1995

International Color Consortium

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For additional information on the ICC:

Todd Newman, Chairman International Color Consortium

Silicon Graphics, Inc.
2011 N. Shoreline Blvd., MS 911
Mountain View, CA 94043
Phone: (415) 390-1614
Internet: tdn@sgi.com

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Table of Contents

0 Introduction

This specification describes the International Color Profile Format. The intent of this format is to provide a cross-platform device profile format.Such device profiles can be used to translate color data created on one device into another device's native color space. The acceptance of this format by operating system vendors allows end users to transparently move profiles and images with embedded profiles between different operating systems. For example, this allows a printer manufacturer to create a single profile for multiple operating systems.

A large number of companies and individuals from a variety of industries participated in very extensive discussions on these issues. Many of these discussions occurred under the auspices of Forshungsgesellschaft Druck e.V. (FOGRA), the German graphic arts research institute during 1993. The present specification evolved from these discussions and the ColorSync™ 1.0 profile format.

This is a very complex set of issues and the organization of this document strives to provide a clear, clean, and unambiguous explanation of the entire format. To accomplish this, the overall presentation is from a top-down perspective, beginning with a summary overview and continuing down into more detailed specifications to a byte stream description of format.

0.1 Intended Audience

This specification is designed to provide developers and other interested parties a clear description of the profile format. A nominal understanding of color science is assumed, such as familiarity with the CIELAB color space, general knowledge of device characterizations familiarity of at least one operating system level color management system.~~operating system level color management system~~.

0.2 Organizational Description of This Specification

This specification is organized into a number of major clauses and annexes. Each clause and subclause is numbered for easy reference. A brief introduction is followed by a detailed summary of the issues involved in this document including: International Color Consortium, device profiles, the profile connection space (PCS), tagged element structure, embedded profiles, profile classifications, color transformations, and color model arbitration.

Clause 1 described the scope of this specification.

Clause 2 provides the normative references for this specification.

Clause 3 described the conformance requirements for this specification.

Clause 4 provides general a definitions used within this standard.

Clause 5 provides descriptions of notations, symbols and abbreviations used in this specification.

Clause 6 described the requirements of this specification. Sub-clause 6.1 'Header Description' describes the format header definition. Sub-clause 6.2 'Tag Table Definition' describes the tag table. Sub-clause 6.3 'Device Profile Requirements' provides a top level view of what tags are required for each type of profile classification and a brief description of the algorithmic models associated with these classes along. Four additional color transformation formats are also described: device link, color space conversion, abstract transformations, and named color transforms. Sub-clause 6.4 'Tag Descriptions' is a detailed algorithmic and intent description of all of the tagged elements described in the previous sections. Sub-clause 6.5 'Tag Type Definitions' provides a byte stream definition of the structures that make up the tags in clause 6.4.

Annex A : 'Color Spaces' describes the color spaces used in this specification. Annex B : 'Embedding Profiles' provides the necessary details to embed profiles into PICT, TIFF, and EPS files. Annex C : 'C Header File Example' provides cross-platform ANSI-C compatible header file example for each of the device profile and color transform formats. Annex D : 'PostScript Level 2 Tags' provides a general description of the PostScript Level 2 tags used in this specification. Annex E : 'Profile Connection Space Explanation' is a paper describing details of the profile connection space.

0.3 International Color Consortium

Considering the potential impact of this standard on various industries, a consortium has been formed that will administer this specification and the registration of tag signatures and descriptions. The founding members of this consortium include; Adobe Systems Inc., Agfa-Gevaert N.V., Apple Computer, Inc., Eastman Kodak Company, FOGRA (Honorary), Microsoft Corporation, Silicon Graphics, Inc., Sun Microsystems, Inc., and Taligent, Inc. These companies have committed to fully support this specification in their operating systems, platforms and applications.

0.4 Device Profiles

Device profiles provide color management systems with the information necessary to convert color data between native device color spaces and device independent color spaces. This specification divides color devices into three broad classifications: input devices, display devices and output devices. For each device class, a series of base algorithmic models are described which perform

the transformation between color spaces. These models provide a range of color quality and performance results. Each of the base models provides different trade-offs in memory footprint, performance and image quality. The necessary parameter data to implement these models is described in the required portions on the appropriate device profile descriptions. This required data provides the information for the color management framework default color management module (CMM) to transform color information between native device color spaces. A representative architecture using these components is illustrated in Figure 1 below.

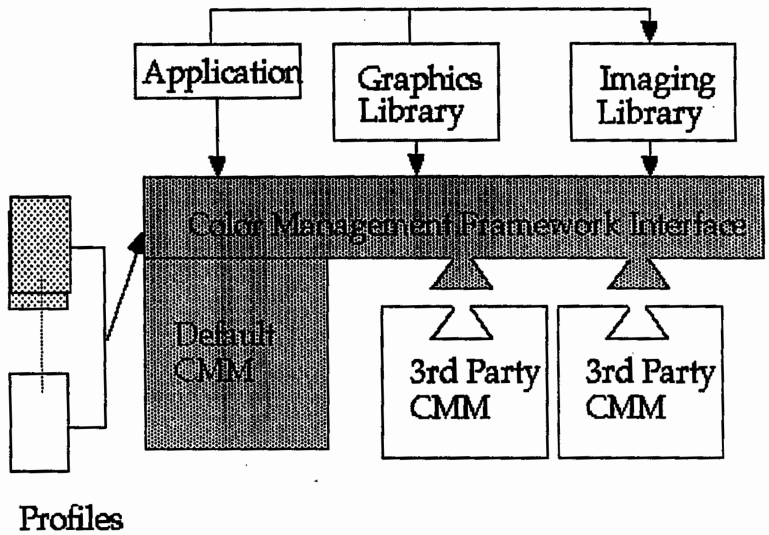

FIGURE 1.

0.5 Profile Element Structure

The profile structure is defined as a header followed by a tag table followed by a series of tagged elements that can be accessed randomly and individually. This collection of tagged elements provides three levels of information for developers: required data, optional data and private data. An element tag table provides a table of contents for the tagging information in each individual profile. This table includes a tag signature and the beginning address offset and size of the data for each individual tagged element. Signatures in this specification are defined as a four byte hexadecimal number. This tagging scheme allows developers to read in the element tag table and then randomly

access and load into memory only the information necessary to their particular software application. Since some instances of profiles can be quite large, this provides significant savings in performance and memory. The detailed descriptions of the tags, along with their intent, are included later in this specification.

The required tags provide the complete set of information necessary for the default CMM to translate color information between the profile connection space and the native device space. Each profile class determines which combination of tags is required. For example, a multi-dimensional lookup table is required for output devices, but not for display devices.

In addition to the required tags for each device profile, a number of optional tags are defined that can be used for enhanced color transformations. Examples of these tags include PostScript Level 2 support, calibration support, and others. In the case of required and optional tags, all of the signatures, an algorithmic description, and intent are registered with the International Color Consortium.

Private data tags allow CMM developers to add proprietary value to their profiles. By registering just the tag signature and tag type signature, developers are assured of maintaining their proprietary advantages while maintaining compatibility with the industry standard. However, the overall philosophy of this format is to maintain an open, cross-platform standard, therefore the use of private tags should be kept to an absolute minimum.

0.6 Embedded Profiles

In addition to providing a cross-platform standard for the actual disk-based profile format, this specification also describes the convention for embedding these profiles within graphics documents and images. Embedded profiles allow users to transparently move color data between different computers, networks and even operating systems without having to worry if the necessary profiles are present on the destination systems. The intention of embedded profiles is to allow the interpretation of the associated color data. Embedding specifications are described in Annex B : 'Embedding Profiles' of this document.

0.7 Registration Authority

This standard requires that signatures for CMM type, device manufacturer, device model, profile tags and profile tag types be registered to insure that all profile data is uniquely defined. The registration authority for these data is the ICC Technical Secretary:

Michael Has
FOGRA

Streitfieldstrasse 19
D-81673 Munich, Germany
Tel: 49-89-4318241
Fax: 49-89-431-6896.

If and when this document becomes an International Standard this registration responsibility must be brought into conformance with ISO procedures. These procedures are being investigated on behalf of ICC and TC130.

0.8 Redundant Data Arbitration

There are several methods of color rendering described in the following structures that can function within a single CMM. If data for more than one method are included in the same profile, the following selection algorithm should be used by the software implementation: if an 8 bit or 16 bit lookup table is present, it should be used; if a lookup table is not present (and not required), the appropriate default modeling parameters are used.

1 Scope

This International Standard defines the data necessary to describe the color characteristics used to input, display, or output images, and an associated file format for the exchange of this data.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

CIE Publication 15.2-1986, "Colorimetry"

ISO 5/1:1984, "Photography (sensitometry) - Density measurements - Terms, symbols and notation"

ISO 5/2:1991, "Photography- Density measurements - Part 2: Geometric conditions for transmission density"

ISO 5/4:1983, "Photography - Density measurements - Part 4: Geometric conditions for reflection density"

ISO/IEC 646:1991, Information technology - ISO 7-bit coded character set for information interchange.

ISO 3664:1975, "Photography - Illumination conditions for viewing colour transparencies and their reproductions" (Need to check against ANSI PH2.30-1989)

ISO 12641- 199X, Graphic technology - Prepress digital data exchange - Colour targets for input scanner calibration (Equals IT8.7/1 and IT8.7/2)

ISO 12642 - 199X, Graphic technology - Prepress digital data exchange - Input data for characterization of 4-colour process printing (Equals IT8.7/3)

ISO 13655 - 199X, Graphic technology - Spectral measurement and colorimetric computation for images (Equals CGATS.5)

CIE 15.2-1986, Colorimetry, Second Edition

PostScript - Language Reference Manual, Second Edition, Adobe Systems Inc., Second Edition

TIFF 6.0 Specification, published by Adobe Systems Inc.,

PICT Standard Specifications, published by APPLE Computers,

3 Conformance

Any color management system, application, utility or device driver that is in conformance with this standard shall have the ability to read the profiles as they are defined in this standard. Any profile generating software and/or hardware that is in conformance with this standard shall have the ability to create profiles as they are defined in this standard. ICC conforming software will use the ICC profiles in an appropriate manner.

4 Definitions

For the purposes of this standard, the following definitions shall apply:

4.1 aligned

A data element is aligned with respect to a data type if the address of the data element is an integral multiple of the number of bytes in the data type.

4.2 ASCII

a string of bytes, each containing a graphic character from ISO 646, the last character in the string being a "null" (character 0/0)

4.3 BCD

Binary Coded Decimal

4.4 big-endian

addressing the bytes within a short or long from the most significant to the lest significant, as the byte address increases

4.5 BYTE

an eight-bit unsigned binary integer

4.6 CMM

Color Management Module

4.7 Fixed Point Math

(We need a definition of Fixed Point Math)

Note: Many of the tag types contain fixed point numbers..Several references can be found (Nethou MetaFonts, etc.) illustrating the preferability of fixed point math to pure floating point math in very structured circumstances.

4.8 little-endian

addressing the bytes within a short or long from the least significant to the most significant, as the byte address increases

4.9 LONG

a 32-bit unsigned binary integer

4.10 offset

an address within a TIFF/IT file, relative to byte zero of the file

4.11 offset value

a short or long value within a TIFF/IT file, containing the offset of a data element

4.12 perceptual

A rendering intent that specifies the full gamut of the image is compressed or expanded to fill the gamut of the destination device. Gray balance is preserved but colorimetric accuracy might not be preserved.

4.13 Rendering Intent

Rendering intent specifies the style of reproduction to be used during the evaluation of this profile in a sequence of profiles. It applies specifically to that profile in the sequence and not to the entire sequence. Typically, the user or application will set the rendering intent dynamically at runtime or embedding time.

4.14 saturation

A rendering intent that specifies the saturation of the pixels in the image is preserved perhaps at the expense of accuracy in hue and lightness.

4.15 SHORT

a 16-bit unsigned binary integer

4.16 TIFF

the TIFF 6.0 specification published by Adobe Corporation

4.17 word-aligned sequence

an even number of consecutive bytes beginning at an even offset.

5 Notation, symbols and abbreviations

All numeric values in this standard are expressed in decimal, unless otherwise indicated and literal strings are denoted in this standard by enclosing them in single quotation marks.

The following symbols and abbreviations are used in this specification.

5.1 General

5.1.1 **BP**: Byte position within a label. For ease of use with ISO 1001, byte positions start at 1.

5.1.2 **h**: A letter "h" is suffixed to denote a hexadecimal value.

5.1.3 **L**: Length of field in number of byte positions.

5.1.4 **SPACE** or "b": The character coded in position 2/0 of ISO/IEC 646.

5.1.5 **ZERO**: The character coded in position 3/0 of ISO/IEC 646.

5.2 Basic Numeric Types

5.2.1 **dateTimeNumber**: This dateTimeNumber is a 12 byte value representation of the time and date. The actual values are encoded as 16 bit unsigned integers.

Byte Position	Field name
0-1	number of the year (actual year, i.e. 1994)
2-3	number of the month (1-12)
4-5	number of the day of the month (1-31)
6-7	number of hours (0-23)
8-9	number of minutes (0-59)
10-11	number of seconds (0-59)

TABLE 1.

5.2.2 **s15Fixed16Number** (s15.16): This type represents a fixed signed 4 byte/32

bit quantity which has 16 fractional bits. An example of this encoding is:

-32768.0	80000000h
0	00000000h
1.0	00010000h
32767 + (65535/65536)	7fffffffh
-32768.0	80000000h

TABLE 2.

5.2.3 **u6Fixed6Number:** This type represents a fixed unsigned 2 byte/16 bit quantity which has 8 fractional bits. An example of this encoding is:

0	0000h
1.0	0100h
255 + (255/256)	ffffh

TABLE 3.

5.2.4 **uInt16Number:** This type represents a generic unsigned 2 byte/16 bit quantity.

5.2.5 **uInt32Number:** This type represents a generic unsigned 4 byte/32 bit quantity.

5.2.6 **uInt64Number:** This type represents a generic unsigned 8 byte/64 bit quantity.

5.2.7 **uInt8Number:** This type represents a generic unsigned 1 byte/8 bit quantity.

5.2.8 **XYZNumber:** This type represents a set of three fixed signed 4 byte/32 bit quantities used to encode CIEXYZ tristimulus values where byte usage is assigned as follows:

BP	Content	Encoding
0-3	CIE X	s15Fixed16Number
4-7	CIE Y	s15Fixed16Number
8-11	CIE Z	s15Fixed16Number

TABLE 4.

For relative tristimulus values, the XYZNumbers are scaled such that a

perfect reflecting diffuser has a Y value of 1.0 and NOT 100.0.

5.2.9 Seven Bit ASCII

Hexademimal															
00	nul	01	soh	02	stx	03	etx	04	eol	05	enq	06	ack	07	bel
08	bs	09	hl	0a	nl	0b	vt	0c	np	0d	cr	0e	so	0f	sl
10	dle	11	dc1	12	dc2	13	dc3	14	dc4	15	nak	16	syn	17	etb
18	can	19	em	1a	sub	1b	esc	1c	fs	1d	gs	1e	rs	1f	us
20	sp	21	I	22	"	23	#	24	$	25	%	26	&	27	'
28	(	29	)	2a	*	2b	+	2c	,	2d	-	2e	.	2f	/
30	0	31	1	32	2	33	3	34	4	35	5	36	6	37	7
38	8	39	9	3a	:	3b	;	3c	<	3d	=	3e	>	3f	?
40	@	41	A	42	B	43	C	44	D	45	E	46	F	47	G
48	H	49	I	4a	J	4b	K	4c	L	4d	M	4e	N	4f	O
50	P	51	Q	52	R	53	S	54	T	55	U	56	V	57	W
58	X	59	Y	5a	Z	5b	[	5c	\	5d	]	5e	^	5f	_
60	`	61	a	62	b	63	c	64	d	65	e	66	f	67	g
68	h	69	i	6a	j	6b	k	6c	l	6d	m	6e	n	6f	o
70	p	71	q	72	r	73	s	74	t	75	u	76	v	77	w
78	x	79	y	7a	z	7b	{	7c	7d	}	7e	~	7f	del	

TABLE 5.

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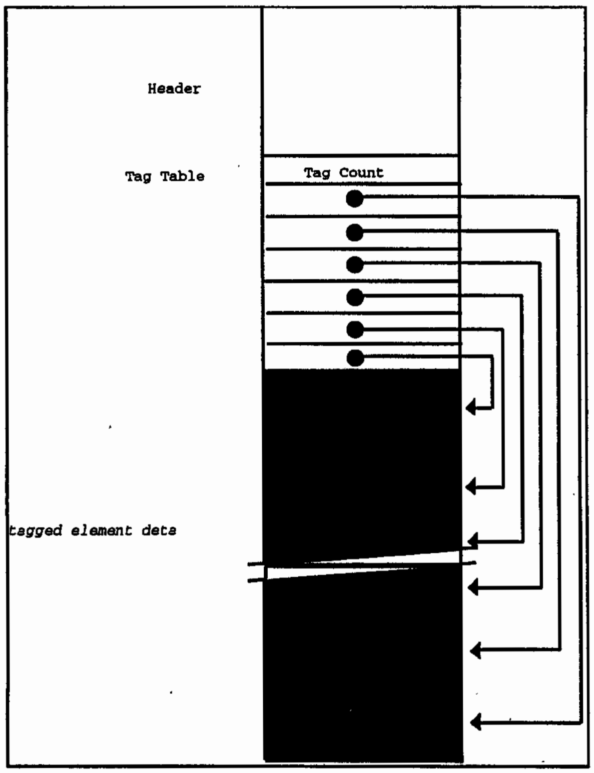
Decimal															
000	nul	001	soh	002	stx	003	etx	004	eot	005	enq	006	ack	007	bel
010	bs	011	ht	012	nl	013	vt	014	np	015	cr	016	so	017	si
020	dle	021	dc1	022	dc2	023	dc3	024	dc4	025	nak	026	syn	027	etb
030	can	031	em	032	sub	033	esc	034	fs	035	gs	036	rs	037	us
040	sp	041	!	042	"	043	#	044	$	045	%	046	&	047	'
50	(	051	)	052	*	053	+	054	,	055	-	056	.	057	/
060	0	061	1	062	2	063	3	064	4	065	5	066	6	067	7
070	8	071	9	072	:	073	;	074	<	075	=	076	>	077	?
100	@	101	A	102	B	103	C	104	D	105	E	106	F	107	G
110	H	111	I	112	J	113	K	114	L	115	M	116	N	117	O
120	P	121	Q	122	R	123	S	124	T	125	U	126	V	127	W
130	X	131	Y	132	Z	133	[	134	\	135	]	136	^	137	_
140	`	141	a	142	b	143	c	144	d	145	e	146	f	147	g
150	h	151	i	152	j	153	k	154	l	155	m	156	n	157	o
160	p	161	q	162	r	163	s	164	t	165	u	166	v	167	w
170	x	171	y	172	z	173	{	174	175	}	176	~	177	del	

TABLE 6.

6 Requirements

A color data exchange device color profile shall include the following elements, in the order shown below in Figure 2, as a single file.

FIGURE 2. **Profile Map**



The 128 byte file header as defined in clause 6.1 'Header Description'.

The tag table as defined in clause 6.2 'Tag Table Definition'.

The tag data elements in accordance with the requirements of clauses 6.3 'Device Profile Requirements', 6.4 'Tag Descriptions' and 6.5 'Tag Type Definitions'.

Note: The information necessary to understand and create the Tag Data Elements is arranged within this standard as follows. Each class, and subclass, of device (e.g.: input, RGB) requires the use of specific tags and allows other optional tags. These relationships are described in clause 6.3 'Device Profile Requirements'. Tags themselves are described in clause 6.4 'Tag Descriptions'. However tag descriptions draw upon a series of commonly used "tag types" which are defined in clause 6.5 'Tag Type Definitions'. The definition of the basic number types used for data encoding and the classes of ASCII codes used are found in clause 5 'Notation, symbols and abbreviations'.

All profile data must be encoded as big-endian.

All color spaces used in this standard shall be in accordance with Annex A : 'Color Spaces'.

6.1 Header Description

The profile header provides the necessary information to allow a receiving system to properly search and sort color data exchange device color profiles. The following Table 7 gives the byte position, content and encoding of the profile header.

This header provides a set of parameters at the beginning of the profile format. For color transformation profiles, the device profile dependent fields are set to zero if irrelevant. Having a fixed length header allows for performance enhancements in the profile searching and sorting operations.

byte(s)	content	Encoded As...
0-3	Profile size	
4-7	Identifies the preferred CMM to be used.	
8-11	Profile version number	see below
12-15	Profile/Device class	
16-19	Color space of data (possibly a derived space) [i.e. "the canonical input space"]	see below
20-23	Profile connection space [i.e. "the canonical output space"]	see below
24-35	Date and time this profile was first created	dateTimeNumber
36-39	'acsp' (0x61637370) profile file signature	
40-43	Primary platform target for the profile	

TABLE 7.

44-47	Flags to indicate various options for the CMM such as distributed processing and caching options	see below
48-51	Device manufacturer of the device for which this profile is created	see below
52-55	Device model of the device for which this profile is created	see below
56-63	Device attributes unique to the particular device setup such as media type	see below
64-67	Specifies the rendering intent of this profile for the CMM. Perceptual, relative colorimetric, saturation and absolute colorimetric are the four intents required to be supported with default values of 0, 1, 2 and 3 respectively.	see below
68-79	The XYZ values of the illuminant of the profile connection space. This must correspond to D50. It is explained in more detail in section 2.	XYZNumber
80-127	48 bytes reserved for future expansion	

TABLE 7.

6.1.1 Profile size:

The total size of the profile as an unsigned long integer.

6.1.2 CMMType

Identifies the preferred CMM to be used. The signatures must be registered in order to avoid conflicts. The Technical Secretary of the International Color Consortium is responsible for the registering of new signatures.

6.1.3 Profile Version

Profile version number where the first 8 bits are the major version number and the next 8 bits are for the minor version number. The major and minor version numbers are set by the International Color Consortium and will match up with the profile format revisions. The current version number is 0x02 with a minor version number of 0x00.

The encoding is such that:

Bytes	content
0	Major Revision in BCD
1	Minor Revision & Bug Fix Revision in each nibble in BCD
2	reserved, must be set to 0
3	reserved, must be set to 0

TABLE 8.

Major version change can only happen if there is an incompatible change. An example of a major version change may be the addition of new required tags. Minor version change can happen with compatible changes. An example of a minor version number change may be the addition of new optional tags.

6.1.4 Profile/Device class

There are three basic classifications (classes) of device profiles: input, display and output profiles.

Within each of these classes there can be a variety of subclasses, such as RGB scanners, CMYK scanners and many others. These basic classes have the following signatures:

signature	description
'scnr'	input devices such as scanners and digital cameras,
'mntr'	display devices such as CRTs and LCDs,
'prtr'	output devices such as printers.

TABLE 9.

In addition to the three basic device profile classes, three additional color processing profiles are defined. These profiles provide a standard implementation for use by the CMM in general color processing or for the convenience of CMMs which may use these types to store calculated transforms. These three profile classes are: device link, color space conversion, and abstract profiles.

Device link profiles provide a mechanism in which to save and store a series of device profiles and non-device profiles in a concatenated format as long as the series begins and ends with a device profile. This is extremely useful for workflow issues where a combination of device profiles and non-device profiles are used repeatedly.

Color space conversion profiles are used as a convenient method for CMMs to convert between different non-device color spaces.

Finally, the abstract color profiles provide a generic method for users to make subjective color changes to images or graphic objects by transforming the color data within the PCS.

These profiles have the following signatures:

signature	description
'link'	device link profiles,
'spac'	color space conversion profiles,
'abst'	abstract profiles.

TABLE 10.

6.1.5 Color Space Signatures

The encoding is such that:

Color Space	Signature	hex encoding
XYZData	'XYZ '	0x58595A20
labData	'Lab '	0x4C616220
luvData	'Luv '	0x4C757620
YCbCrData	'YCbr '	0x59436272
YxyData	'Yxy '	0x59787920
rgbData	'RGB '	0x52474220
grayData	'GRAY'	0x47524159
hsvData	'HSV '	0x48535620
hlsData	'HLS '	0x484C5320
cmykData	'CMYK'	0x434D594B
cmyData	'CMY '	0x434D5920

TABLE 11.

6.1.6 Profile Connection Space Signatures

The encoding is such that:

Profile Connection Color Space	Signature	hex encoding
XYZData	'XYZ '	0x58595A20
labData	'Lab '	0x4C616220

TABLE 12.

When the profile is a DeviceLink profile, the Profile Connection Space Signature is taken from the Color Space Signatures table. (See clause 6.1.5)

6.1.7 Primary Platform Flag

Flags to indicate the primary platform/operating system framework for which the profile was created.

The encoding is such that:

Primary Platform	Signature	hex encoding
Apple Computer, Inc.	'APPL '	0x4150504C
Microsoft Corporation	'MSFT '	0x4D534654
Silicon Graphics, Inc.	'SGI '	0x53474920
Sun Microsystems, Inc.	'SUNW '	0x53554E57
Taligent, Inc.	'TGNT '	0x54474E54

TABLE 13.

6.1.8 ProfileFlags

Flags to indicate various hints for the CMM such as distributed processing and caching options. The first 16 bits (low word in big-endian notation) are reserved for the Profile Consortium.

The encoding is such that:

Flags	Bit Position
Embedded Profile (0 if not embedded, 1 if embedded in file)	0
Profile cannot be used independently from the embedded color data (set to 1 if true, 0 if false)	1

TABLE 14.

6.1.9 Device manufacturer and model:

The signatures for various manufacturers and models are listed in a separate document (ICC Signatures). New signatures must be registered with the ICC.

6.1.10 Attributes

Attributes unique to the particular device setup such as media type. The first 16 bits are reserved for the ICC.

The encoding is such that (with "on" having value 1 and "off" having value 0):

Attribute	bit position
Reflective (off) or Transparency (on)	0
Glossy (off) or Matte (on)	1

TABLE 15.

6.1.11 Rendering Intent:

Perceptual, relative colorimetric, saturation and absolute colorimetric are the four intents required to be supported. The first 16 bits worth of numbers are reserved for the ICC.

The encoding is such that:

Rendering Intent	value
Perceptual	0
Relative Colorimetric	1
Saturation	2
Absolute Colorimetric	3

TABLE 16.

Note that this flag might not have any meaning until the profile is used in some context, e.g. in a DeviceLink or embedded source profile.

6.2 Tag Table Definition

The tag table acts as a table of contents for the tags and tag element data in the profiles. The first four bytes contain a count of the number of tags in the table itself. The tags within the table are not required to be in any particular order.

Individual Tag Structures Within Tag Table

byte(s)	content
0-3	tag signature
4-7	offset to beginning of tag data
8-11	element size for the number of bytes in the tag data element

TABLE 17.

6.2.1 Tag Signatures

A four byte value registered with the ICC technical secretary.

6.2.2 Offset

See clause 4.10 'offset'.

6.2.3 Element Size

Element size for the number of bytes in the tag data element.

6.2.4 Tag Data Requirements

All tag data is required to start on a 4-byte boundary (relative to the start of the profile header) so that a tag starting with a long will be properly aligned without the tag handler needing to know the contents of the tag. This means that the low 2 bits of the beginning offset must be 0. The element size should be for actual data and must not include padding at the end of the tag data.The header is the first element in the file structure encompassing the first 128 bytes. This is immediately followed by the tag table. Tag data elements make up the rest of the file structures. There may be any number of tags and no particular order is required for the data of the tags. Each tag may have any size (up to the limit imposed by the 32 bit offsets). Exactly which tags are required or optional with which profiles have been described in section 3 on Device Profiles.

6.3 Device Profile Requirements

This section provides a top level view of what tags are required for each type of profile classification and a brief description of the algorithmic models associated with these classes. This begins with a subsection describing common tags required of all three device profiles, followed by a general description of each profile class and its required tags. A general description for each tag is included in this section.

Note that these descriptions assume two things; every profile contains a header, and may include additional tags beyond those listed as required in this section. The explicitly listed tags are those which are required in order to comprise a legal profile of each type.

In general, multi-dimensional tables refer to lookup tables with more than one input component.

The intent of requiring tags with profiles is to provide a common base level of functionality. If a custom CMM is not present, then the default CMM will have enough information to perform the requested color transformations. The particular models implied by the required data are also described below. While this data might not provide the highest level of quality obtainable with optional data and private data, the data provided is adequate for sophisticated

device modeling.

Profile	Tag Name	Interpretation
Input Profile	AToB0Tag	none
Display Profile	AToB0Tag	none
Output Profile	BToA0Tag	perceptual rendering
Output Profile	BToA1Tag	colorimetric rendering
Output Profile	BToA2Tag	saturation rendering
Input Profile	grayTRCTag	depends on intent
Display Profile	grayTRCTag	additive
Output Profile	grayTRCTag	subtractive

TABLE 18.

6.3.1 Input Profile

This profile represents input devices such as scanners and digital cameras.

6.3.1.1 Monochrome Input Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
grayTRCTag	Gray tone reproduction curve (TRC)
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 19.

The mathematical model implied by this data is

$linear = redTRC[device]$. This represents a simple tone reproduction curve adequate for most monochrome input devices. The *connection* values in this equation should represent the achromatic channel of the profile connection space. If the inverse of this is desired, then the following equation is used,

$device = grayTRC^{-1}[connection]$.

6.3.1.2 RGB Input Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
redColorantTag	Red colorant XYZ relative tristimulus values
greenColorantTag	Green colorant XYZ relative tristimulus values
blueColorantTag	Blue colorant XYZ relative tristimulus values
redTRCTag	Red channel tone reproduction curve
greenTRCTag	Green channel tone reproduction curve
blueTRCTag	Blue channel tone reproduction curve
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 20.

The forward mathematical model implied by this data is:

$$linear_r = redTRC[device_r]$$
$$linear_g = greenTRC[device_g]$$
$$linear_b = blueTRC[device_b]$$

$$\begin{bmatrix} connection_X \\ connection_Y \\ connection_Z \end{bmatrix} = \begin{bmatrix} redColorant_X & greenColorant_X & blueColorant_X \\ redColorant_Y & greenColorant_Y & blueColorant_Y \\ redColorant_Z & greenColorant_Z & blueColorant_Z \end{bmatrix} \begin{bmatrix} linear_r \\ linear_g \\ linear_b \end{bmatrix}$$

This represents a simple linearization followed by a linear mixing model. The three tone reproduction curves linearize the raw values with respect to the luminance (Y) dimension of the CIEXYZ encoding of the profile connection space. The 3x3 matrix converts these linearized values into XYZ values for the CIEXYZ encoding of the profile connection space. The inverse model is given by

the following equation,

$$\begin{bmatrix} linear_r \\ linear_g \\ linear_b \end{bmatrix} = \begin{bmatrix} redColorant_X & greenColorant_X & blueColorant_X \\ redColorant_Y & greenColorant_Y & blueColorant_Y \\ redColorant_Z & greenColorant_Z & blueColorant_Z \end{bmatrix}^{-1} \begin{bmatrix} connection_X \\ connection_Y \\ connection_Z \end{bmatrix}$$

$$device_r = redTRC^{-1}[linear_r]$$

$$device_g = greenTRC^{-1}[linear_g]$$

$$device_b = blueTRC^{-1}[linear_b]$$

Only the CIEXYZ encoding of the profile connection space can be used with matrix/TRC models. A multidimensional table tag must be included if the CIELAB encoding of the profile connection space is to be used.

6.3.1.3 CMYK Input Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
AToB0Tag	Device to PCS: 8 or 16 bit data
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 21.

The AToB0Tag represents a device model described by the Lut8Type or Lut16Types. This tag provides the parameter data for an algorithm that includes a set of non-interdependent per-channel tone reproduction curves, a multi-dimensional lookup table and a set of non-interdependent per-channel linearization curves. The mathematical model implied by this data is described in detail in clauses 6.5.4 and 6.5.5 that specify the general lookup table tag element structures.

This profile type can be used with a printer for space optimized embedding.

6.3.2 Display Profile

This profile represents display devices such as monitors.

6.3.2.1 Monochrome Display Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
grayTRCTag	Gray tone reproduction curve
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 22.

The mathematical model implied by this data is

$$linear = redTRC[device] \; .$$

This represents a simple tone reproduction curve adequate for most monochrome display devices. The *connection* values in this equation should represent the achromatic channel of the profile connection space. If the inverse of this is desired, then the following equation is used,

$$device = grayTRC^{-1}[connection] \, .$$

Multidimensional tables are not allowed to be included in monochrome profiles.

6.3.2.2 RGB Display Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
redColorantTag	Relative XYZ values of red phosphor
greenColorantTag	Relative XYZ values of green phosphor
blueColorantTag	Relative XYZ values of blue phosphor
redTRCTag	Red channel tone reproduction curve
greenTRCTag	Green channel tone reproduction curve
blueTRCTag	Blue channel tone reproduction curve
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 23.

This model is based on a three non-interdependent per-channel tone

reproduction curves to convert between linear and non-linear rgb values and a 3x3 matrix to convert between linear rgb values and relative XYZ values. The mathematical model implied by this data is:

$$linear_r = redTRC[device_r]$$
$$linear_g = greenTRC[device_g]$$
$$linear_b = blueTRC[device_b]$$

$$\begin{bmatrix} connection_X \\ connection_Y \\ connection_Z \end{bmatrix} = \begin{bmatrix} redColorant_X & greenColorant_X & blueColorant_X \\ redColorant_Y & greenColorant_Y & blueColorant_Y \\ redColorant_Z & greenColorant_Z & blueColorant_Z \end{bmatrix} \begin{bmatrix} linear_r \\ linear_g \\ linear_b \end{bmatrix}$$

This represents a simple linearization followed by a linear mixing model. The three tone reproduction curves linearize the raw values with respect to the luminance (Y) dimension of the CIEXYZ encoding of the profile connection space. The 3x3 matrix converts these linearized values into XYZ values for the CIEXYZ encoding of the profile connection space. The inverse model is given by the following equation,

$$\begin{bmatrix} linear_r \\ linear_g \\ linear_b \end{bmatrix} = \begin{bmatrix} redColorant_X & greenColorant_X & blueColorant_X \\ redColorant_Y & greenColorant_Y & blueColorant_Y \\ redColorant_Z & greenColorant_Z & blueColorant_Z \end{bmatrix}^{-1} \begin{bmatrix} connection_X \\ connection_Y \\ connection_Z \end{bmatrix}$$

$$device_r = redTRC^{-1}[linear_r]$$
$$device_g = greenTRC^{-1}[linear_g]$$
$$device_b = blueTRC^{-1}[linear_b]$$

Only the CIEXYZ encoding of the profile connection space can be used with matrix/TRC models. A multidimensional table tag must be included if the CIELAB encoding of the profile connection space is to be used.

6.3.3 Output Profile

This profile represents output devices such as printers and film recorders. The LUT tags that are required by the printer profiles contain either the 8 bit or the 16 bit LUTs exclusively as described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'. The LUT algorithm for profile connection space to device space

transformations process data sequentially through a matrix, input tables, a color LUT, and output tables.

6.3.3.1 Monochrome Output Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
grayTRCTag	Gray tone reproduction curve
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 24.

The tone reproduction curve provides the necessary information to convert between a single device channel and the CIEXYZ encoding of the profile connection space.

The mathematical model implied by this data is

$$linear = redTRC[device] .$$

This represents a simple tone reproduction curve adequate for most monochrome output devices. The *connection* values in this equation should represent the achromatic channel of the profile connection space. If the inverse of this is desired, then the following equation is used,

$$device = grayTRC^{-1}[connection] .$$

Multidimensional tables are not allowed to be included in monochrome profiles.

6.3.3.2 RGB and CMYK Output Profiles

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
AToB0Tag	Device to PCS: 8 or 16 blt data: intent of 0
BToA0Tag	PCS to Device space: 8 or 16 bit data: intent of 0
gamutTag	Out of Gamut: 8 or 16 bit data
AToB1Tag	Device to PCS: 8 or 16 bit data: intent of 1
BToA1Tag	PCS to Device space: 8 or 16 bit data: intent of 1
AToB2Tag	Device to PCS: 8 or 16 bit data: intent of 2
BToA2Tag	PCS to Device space: 8 or 16 bit data: intent of 2
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 25.

These tags represent a device model described in clause 6.5.5 'lut8Type' or clause 6.5.4 'lut16Type'. The intent values described in these tags directly correlate to the value of the rendering intent header flag of the source profile in the color modeling session.

Rendering Intent	Value
perceptual	0
relative colorimetric	1
saturation	2
absolute colorimetric	3

TABLE 26.

Each of the first three intents are associated with a specific tag. The fourth intent, absolute colorimetry, is obtained by modifying the relative colorimetric intent tag based on the values which are in the mediaWhitePointTag. It is permissible to reference the same tag for all of these intents and to use the relative colorimetric intent tag when absolute colorimetry is specified. This decision is left to the profile builder.

In essence, each of these tags provides the parameter data for an algorithm that includes a 3x3 matrix, a set of non-interdependent per-channel tone reproduction curves, a multidimensional lookup table and a set of non-interdependent per-channel linearization curves. The algorithmic details of this model and the intent of each tag is given later in clauses 6.5.4 'lut16Type' or 6.5.5

'lut8Type' that specify the general lookup table tag element structures.

This profile represents output devices such as printers and film recorders. The LUT tags that are required by the printer profiles contain either the 8 bit or the 16 bit LUTs as described in the LUT tags. The LUT algorithm for profile connection space to device space transformations process data sequentially through a matrix, input tables, a color LUT, and output tables.

6.3.4 Additional Profile Formats

6.3.4.1 DeviceLink Profile

This profile represents a one-way link or connection between devices. It does not represent any device model nor can it be embedded into images.

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
AToB0Tag	Actual transformation parameter structure (this is an exclusive or) 8 or 16 bit data
profileSequence-DescTag	An array of descriptions of the profile sequence
copyrightTag	7 bit ASCII profile copyright information

TABLE 27.

The single AToB0Tag may contain any of the four possible rendering intents. The rendering intent used is indicated in the header of the profile.

The AToB0Tag represents a device model described in clause 6.5.4 'lut16Type' or clause 6.5.5 'lut8Type'. This tag provides the parameter data for an algorithm that includes a 3x3 matrix, a set of non-interdependent per-channel tone reproduction curves, a multidimensional lookup table and a set of non-interdependent per-channel linearization curves. The algorithmic details of this model and the intent of each tag is given later in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type' that specify the general lookup table tag element structures. This is a pre-evaluated transform that cannot be undone.

The color space of data in the DeviceLink profile will be the same as the color space of the data of the first profile in the sequence. The profile connection space will be the same as the color space of the data of the last profile in the sequence.

6.3.4.2 ColorSpaceConversion Profile

This profile provides the relevant information to perform a color space transformation between the non-device color spaces and the PCS. It does not represent any device model.

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
BToA0Tag	Inverse transformation parameter structure (this is an exclusive or) 8 or 16 bit data
AToB0Tag	Actual transformation parameter structure (this is an exclusive or) 8 or 16 bit data
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 28.

The AToB0Tag and BToA0Tag represent a model described in clause 6.5.4 'lut16Type' or clause 6.5.5 'lut8Type'. This tag provides the parameter data for an algorithm that includes a 3x3 matrix, a set of non-interdependent per-channel tone reproduction curves, a multidimensional lookup table and a set of non-interdependent per-channel linearization curves. The algorithmic details of this model and the intent of each tag is given later in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type' that specify the general lookup table tag element structures.

For color transformation profiles, the device profile dependent fields are set to zero if irrelevant.

6.3.4.3 Abstract Profile

This profile represents abstract transforms and does not represent any device model. Color transformations using abstract profiles are performed from PCS to

PCS.

Tag Name	General Description
profileDescriptionTag	Structure containing invariant and localizable versions of the profile name for display
AToB0Tag	Actual transformation parameter structure (this is an exclusive or) 8 or 16 bit data
mediaWhitePointTag	Media XYZ white point
copyrightTag	7 bit ASCII profile copyright information

TABLE 29.

The AToB0Tag represents a PCS to PCS model described by the Lut8Type or Lut16Types. This tag provides the parameter data for an algorithm that includes a 3x3 matrix, a set of non-interdependent per-channel tone reproduction curves, a multidimensional lookup table and a set of non-interdependent per-channel linearization curves. The algorithmic details of this model and the intent of each tag is given later in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type' that specify the general lookup table tag element structures.

6.4 Tag Descriptions

This section specifies the individual tags used to create all possible portable profiles in the ICC Profile Format. The appropriate tag typing is indicated with each individual tag description. Note that the signature indicates only the type of data and does not imply anything about the use or purpose for which the data is intended.

In addition to the tags listed below, any of the previously defined tags in clause 6.3 'Device Profile Requirements' can also be used as optional tags if they are not used in the required set for a particular profile.

Tag Name	General Description
AToB0Tag	Multidimensional transformation structure
AToB1Tag	Multidimensional transformation structure
AToB2Tag	Multidimensional transformation structure
blueColorantTag	Relative XYZ values of blue phosphor or colorant
blueTRCTag	Blue channel tone reproduction curve
BToA0Tag	Multidimensional transformation structure
BToA1Tag	Multidimensional transformation structure

TABLE 30.

BToA2Tag	Multidimensional transformation structure
calibrationDateTimeTag	Profile calibration date and time
charTargetTag	Characterization target such as IT8/7.2
copyrightTag	7 bit ASCII profile copyright information
deviceMfgDescTag	displayable description of device manufacturer
deviceModelDescTag	displayable description of device model
gamutTag	Out of Gamut: 8 or 16 bit data
grayTRCTag	Gray tone reproduction curve
greenColorantTag	Relative XYZ values of green phosphor or colorant
greenTRCTag	Green channel tone reproduction curve
luminanceTag	Absolute luminance for emissive device
measurementTag	Alternative measurement specification information
mediaBlackPointTag	Media XYZ black point
mediaWhitePointTag	Media XYZ white point
namedColorTag	Dictionary for converting between named colors and interchange or device color spaces
preview0Tag	Preview transformation: 8 or 16 bit data
preview1Tag	Preview transformation: 8 or 16 bit data
preview2Tag	Preview transformation: 8 or 16 bit data
profileDescriptionTag	profile description for display
profileSequenceDescTag	profile sequence from source to destination
ps2CRD0Tag	PostScript Level 2 color rendering dictionary: perceptual
ps2CRD1Tag	PostScript Level 2 color rendering dictionary: colorimetric
ps2CRD2Tag	PostScript Level 2 color rendering dictionary: saturation
ps2CRD3Tag	PostScript Level 2 color rendering dictionary: absolute
ps2CSATag	PostScript Level 2 color space array
ps2RenderingIntentTag	PostScript Level 2 Rendering Intent
redColorantTag	Relative XYZ values of red phosphor or colorant
redTRCTag	Red channel tone reproduction curve

TABLE 30.

screeningDescTag	Screening attributes description
screeningTag	Screening attributes such as frequency, angle and spot
technologyTag	Device technology information such as LCD, CRT, Dye Sublimation, etc.
ucrbgTag	Under color removal curve
viewingCondDescTag	Specifies viewing condition description
viewingConditionsTag	Specifies viewing condition parameters

TABLE 30.

6.4.1 AToB0Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'A2B0' 0x41324230

Device to PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.2 AToB1Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'A2B1' 0x41324231

Device to PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.3 AToB2Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : T'A2B2' 0x41324232

Device to PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.4 blueColorantTag

Tag Type : XYZType
Tag Signature : 'bXYZ' 0x6258595A

The relative XYZ values of blue phosphor or colorant.

6.4.5 blueTRCTag

Tag Type : curveType
Tag Signature : 'bTRC' 0x62545243

Blue channel tone reproduction curve. The first element represents no colorant (white) or phosphors (black) and the last element represents 100 percent colorant (blue) or 100 percent phosphor (blue).

The count value specifies the number of entries in the curve table except as follows:

when count is 0, then a linear response (slope equal to 1.0) is assumed,

when count is 1, then the data entry is interpreted as a simple gamma value ranging from 0 to 8 in fixed unsigned 8.8 format).

Gamma is interpreted canonically and NOT as an inverse.

6.4.6 BToA0Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'B2A0' 0x42324130

PCS to Device space: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.7 BToA1Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'B2A1' 0x42324131

PCS to Device space: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.8 BToA2Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'B2A2' 0x42324132

PCS to Device space: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.9 calibrationDateTimeTag

Tag Type : dateTimeType
Tag Signature : 'calt' 0x63616C74

Profile calibration date and time. Initially, this tag matches the contents of the creationDateTime header flag. This allows applications and utilities to verify if this profile matches a vendor's profile and how recently calibration has been performed.

6.4.10 charTargetTag

Tag Type : textType
Tag Signature : 'targ' 0x74617267

This tag contains the measurement data for a characterization target such as IT8.7/2. This tag is provided so that distributed utilities can create transforms "on the fly" or check the current performance against the original device performance. The tag embeds the exact data file format defined in the ANSI or ISO standard which is applicable to the device being characterized.

Examples are the data formats described in ANSI IT8.7/1-1993 section 4.10, ANSI IT8.7/2-1993 section 4.10 and ANSI IT8.7/3 section 4.10. Each of these file formats contains an identifying character string as the first few bytes of the format, allowing an external parser to determine which data file format is being used. This provides the facilities to include a wide range of targets using a variety of measurement specifications in a standard manner.

> Note: The IT8 specifications do not currently have a keyword which identifies the set as being reference data as opposed to device response data. An addition to enable this additional data set is being considered by the IT8 committee.

6.4.11 copyrightTag

Tag Type : textType
Tag Signature : 'cprt' 0x63707274

This tag contains the 7 bit ASCII text copyright information for the profile.

6.4.12 deviceMfgDescTag

Tag Type : textDescriptionType
Tag Signature : 'dmnd' 0x646D6E64

Structure containing invariant and localizable versions of the device manufacturer for display. The content of this structure is described in clause 6.5.9 'textDescriptionType'.

6.4.13 deviceModelDescTag

Tag Type : textDescriptionType
Tag Signature : 'dmdd' 0x646D6464

Structure containing invariant and localizable versions of the device model for display. The content of this structure is described in clause 6.5.9 'textDescriptionType'.

6.4.14 gamutTag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'gamt' 0x67616D74

Out of Gamut tag: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

The CLUT tag has a single output. If the output value is 0, the input color is in gamut. If the output is non-zero, the input color is out of gamut, with the number "n+1" being at least at far out of the gamut as the number "n".

6.4.15 grayTRCTag

Tag Type : curveType
Tag Signature : 'kTRC' 0x6B545243

Gray tone reproduction curve. The tone reproduction curve provides the necessary information to convert between a single device channel and the CIEXYZ encoding of the profile connection space. The first element represents no colorant (white) or phosphors (black) and the last element represents 100 percent colorant (black) or 100 percent phosphor (white).

The count value specifies the number of entries in the curve table except as follows:

when count is 0, then a linear response (slope equal to 1.0) is assumed,

when count is 1, then the data entry is interpreted as a simple gamma value ranging from 0 to 8 in fixed unsigned 8.8 format).

Gamma is interpreted canonically and NOT as an inverse.

4.16 greenColorantTag

ag Type : XYZType
ag Signature : 'gXYZ' 0x6758595A

Relative XYZ values of green phosphor or colorant.

4.17 greenTRCTag

ag Type : curveType
ag Signature : 'gTRC' 0x67545243

Green channel tone reproduction curve. The first element represents no colorant (white) or phosphors (black) and the last element represents 100 percent colorant (green) or 100 percent phosphor (green).

The count value specifies the number of entries in the curve table except as follows:

when count is 0, then a linear response (slope equal to 1.0) is assumed,

when count is 1, then the data entry is interpreted as a simple gamma value ranging from 0 to 8 in fixed unsigned 8.8 format).

Gamma is interpreted canonically and NOT as an inverse.

4.18 luminanceTag

ag Type : XYZType
ag Signature : 'lumi' 0x6C756D69

bsolute luminance of devices is in candelas per meter squared as described by the Y channel. The X and Z channels are ignored in all cases.

19 measurementTag

g Type : measurementType
g Signature : 'meas' 0x6D656173

lternative measurement specification such as a D65 illuminant instead of the efault D50.

20 mediaBlackPointTag

g Type : XYZType

Tag Signature : 'bkpt' 0x626b7074

This tag specifies the media black point and is used for generating absolute colorimetry. It is referenced to the profile connection space so that the media black point as represented in the PCS is equivalent to this tag value. If this tag is not present, it is assumed to be (0,0,0).

6.4.21 mediaWhitePointTag

Tag Type : XYZType
Tag Signature : 'wtpt' 0x77747074

This tag specifies the media white point and is used for generating absolute colorimetry. It is referenced to the profile connection space so that the media white point as represented in the PCS is equivalent to this tag value.

6.4.22 namedColorTag

Tag Type : namedColorType
Tag Signature : 'ncol' 0x6E636F6C

Named color reference transformation for converting between named color sets and the profile connection space or device color spaces.

6.4.23 preview0Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'pre0' 0x70726530

Preview transformation from PCS to device space and back to the PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.24 preview1Tag

Tag Type : lut8Type xor lut16Type
Tag Signature : 'pre1' 0x70726531

Preview transformation from the PCS to device space and back to the PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.25 preview2Tag

Tag Type : lut8Type xor lut16Type

Tag Signature : 'pre2' 0x70726532

Preview transformation from PCS to device space and back to the PCS: 8 bit or 16 bit data. The processing mechanisms are described in clauses 6.5.4 'lut16Type' and 6.5.5 'lut8Type'.

6.4.26 profileDescriptionTag

Tag Type : textDescriptionType
Tag Signature : 'desc' 0x64657363

Structure containing invariant and localizable versions of the profile description for display. This content of this structure is described in clause 6.5.9 'textDescriptionType'. This invariant description has no fixed relationship to the actual profile disk file name.

6.4.27 profileSequenceDescTag

Tag Type : profileSequenceDescType
Tag Signature : 'pseq' 0x70736571

Structure containing a description of the profile sequence from source to destination, typically used with the devicelink profile. This content of this structure is described in clause 6.5.8 'profileSequenceDescType'.

6.4.28 ps2CRD0Tag

Tag Type : dataType
Tag Signature : 'psd0' 0x70736430

PostScript Level 2 Type 1 color rendering dictionary (CRD) for the Perceptual rendering intent. This tag provides the dictionary operand to the setcolorrendering operator. This tag can be used in conjunction with the setcolorrendering operator on any PostScript Level 2 device.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.29 ps2CRD1Tag

Tag Type : dataType
Tag Signature : 'psd1' 0x70736431

PostScript Level 2 Type 1 CRD for the RelativeColorimetric rendering intent. This tag provides the dictionary operand to the setcolorrendering operator. This

tag can be used in conjunction with the setcolorrendering operator on any PostScript Level 2 device.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.30 ps2CRD2Tag

Tag Type : dataType
Tag Signature : 'psd2' 0x70736432

PostScript Level 2 Type 1 CRD for the Saturation rendering intent. This tag provides the dictionary operand to the setcolorrendering operator. This tag can be used in conjunction with the setcolorrendering operator on any PostScript Level 2 device.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.31 ps2CRD3Tag

Tag Type : dataType
Tag Signature : 'psd3' 0x70736433

PostScript Level 2 Type 1 CRD for the AbsoluteColorimetric rendering intent. This tag provides the dictionary operand to the setcolorrendering operator. This tag can be used in conjunction with the setcolorrendering operator on any PostScript Level 2 device.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.32 ps2CSATag

Tag Type : dataType
Tag Signature : 'ps2s' 0x70733273

PostScript Level 2 color space array. This tag provides the array operand to the setcolorspace operator. For color spaces that fit within the original PostScript Level 2 device independent color model no operator verification need be performed. For color spaces that fit only within extensions to this model, operator verification is first required. An example of this would be for Calibrated CMYK input color spaces which are supported via an extension. In such cases where the necessary PostScript Level 2 support is not available, PostScript Level 1 color spaces, such as DeviceCMYK, can be used, or the colors

can be converted on the host using a CMS. In the latter case, the PostScript Level 1 color operators are used to specify the device dependent (pre-converted) colors. The PostScript contained in this tag expects the associated color values instantiated either through setcolor or image to be in the range [0, 1].

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.33 ps2RenderingIntentTag

Tag Type : dataType
Tag Signature : 'ps2i' 0x70733269

PostScript Level 2 rendering intent. This tag provides the operand to the findcolorrendering operator. findcolorrendering is not necessarily supported on all PostScript Level 2 devices, hence its existence must first be established. Standard values for ps2RenderingIntentTag are RelativeColorimetric, AbsoluteColorimetric, Perceptual, and Saturation. These intents are meant to correspond to the rendering intents of the profile's header.

See Annex D : 'PostScript Level 2 Tags', for the relationship between the ICC profile data and PostScript Tags.

6.4.34 redColorantTag

Tag Type : XYZType
Tag Signature : 'rXYZ' 0x7258595A

Relative XYZ values of red phosphor or colorant.

6.4.35 redTRCTag

Tag Type : curveType
Tag Signature : 'rTRC' 0x72545243

Red channel tone reproduction curve. The first element represents no colorant (white) or phosphors (black) and the last element represents 100 percent colorant (red) or 100 percent phosphor (red).

The count value specifies the number of entries in the curve table except as follows:

when count is 0, then a linear response (slope equal to 1.0) is assumed,

when count is 1, then the data entry is interpreted as a simple gamma

value ranging from 0 to 8 in fixed unsigned 8.8 format).

Gamma is interpreted canonically and NOT as an inverse.

6.4.36 screeningDescTag

Tag Type : textDescriptionType
Tag Signature : 'scrd' 0x73637264

Structure containing invariant and localizable versions of the screening conditions. This content of this structure is described in clause 6.5.9 'textDescriptionType'.

6.4.37 screeningTag

Tag Type : screeningType
Tag Signature : 'scrn' 0x7363726E

This tag contains screening information for a variable number of channels.

6.4.38 technologyTag

Tag Type : signatureType
Tag Signature : 'tech' 0x74656368

Device technology information such as CRT, Dye Sublimation, etc. If this tag is not used

The encoding is such that:

Technology	signature	hex signature
Film Scanner	'fscn'	0x6673636E
Digital Camera	'dcam'	0x6463616D
Reflective Scanner	'rscn'	0x7273636E
Ink Jet Printer	'ijet'	0x696A6574
Thermal Wax Printer	'twax'	0x74776178
Electrophotographic Printer	'epho'	0x6570686F
Electrostatic Printer	'esta'	0x65737461
Dye Sublimation Printer	'dsub'	0x64737562
Photographic Paper Printer	'rpho'	0x7270686F
Film Writer	'fprn'	0x6670726E

TABLE 31.

Video Monitor	'vidm'	0x7669646D
Video Camera	'vidc'	0x76696463
Projection Television	'pjtv'	0x706A7476
Cathode Ray Tube Display	'CRT '	0x43525420
Passive Matrix Display	'PMD '	0x504D4420
Active Matrix Display	'AMD '	0x414D4420
Photo CD	'KPCD'	0x4B504344
PhotoImageSetter	'imgs'	0x696D6773
Gravure	'grav'	0x67726176
Offset Lithography	'offs'	0x6F666673
Silkscreen	'silk'	0x73696C6B
Flexography	'flex'	0x666C6578

TABLE 31.

6.4.39 ucrbgTag

Tag Type : ucrbgType
Tag Signature : 'bfd ' 0x62666420

Under color removal and black generation specification. This tag contains curve information for both under color removal and black generation in addition to a general description. This content of this structure is described in clause 6.5.15 'ucrbgType'.

6.4.40 viewingCondDescTag

Tag Type : Tag Type: textDescriptionType
Tag Signature : 'vued' 0x76756564

Structure containing invariant and localizable versions of the viewing conditions. This content of this structure is described in clause 6.5.9 'textDescriptionType'.

6.4.41 viewingConditionsTag

Tag Type : viewingConditionsType
Tag Signature : 'view' 0x76696577

Viewing conditions parameters.

6.5 Tag Type Definitions

This section specifies the type and structure definitions used to create all of the individual tagged elements in ICC Profile Format. The data type description identifiers are indicated at the right margin of each data or structure definition. An effort was made to make sure one-byte, two-byte and four-byte data lies on one-byte, two-byte and four-byte boundaries respectively, this required occasionally including extra spaces indicated with "reserved for padding" in some tag type definitions. Value 0 is defined to be of "unknown value" for all enumerated data structures.

All tags, including private tags, have as their first four bytes (0-3) a tag signature (a 4 byte character sequence) to identify to profile readers what kind of data is contained within a tag. This encourages tag type reuse and allows profile parsers to reuse code when tags use common tag types. The second four bytes (4-7) are reserved for future expansion and must be set to 0 in this version of the specification. Each new tag signature and tag type signature must be registered with the International Color Consortium in order to prevent signature collisions.

Where not specified otherwise, the low 16 bits of all 32 bit flags in the type descriptions below are reserved for use by the International Color Consortium.

When 7 bit ASCII text representation is specified in types below, each individual character is encoded in 8 bits with the high bit set to zero. The details are presented in Appendix C.

6.5.1 curveType

The curveType contains a 4 byte count value and a one-dimensional table of 2 byte values. The byte stream is given below.

byte(s)	content
0-3	'curv'(0x63757276) type descriptor
4-7	reserved, must be set to 0
8-11	count value specifying number of entries that follow
12-end	actual curve values starting with the zeroth entry and ending with the entry count-1.

TABLE 32.

Unless otherwise specified (see clauses 6.4.5 'blueTRCTag', 6.4.15 'grayTRCTag', 6.4.17 'greenTRCTag',and 6.4.35 'redTRCTag') curve values are in the range [0.0, 1.0]. These 16 bit unsigned integers in the range 0 to (2^16)-1

(65535) linearly map to curve values in the interval [0.0, 1.0].

6.5.2 dataType

The dataType is a simple data containing structure that contains either 7 bit ASCII or binary data, i.e. textType data or transparent 8-bit bytes. The length of the string can easily be obtained from the element size portion of the tag itself. If this type is used for ASCII data, it must be terminated with a 0x00 byte.

byte(s)	content
0-3	'data'(0x64617461) type descriptor
4-7	reserved, must be set to 0
8-11	data flag, 0x00000000 represents ASCII data, 0x00000001 represents binary data, other values are reserved for future use
12-n	a string of count ASCII characters or count bytes (where count is derived from the element size portion of the tag itself)

TABLE 33.

6.5.3 dateTimeType

This dateTimeType is a 12 byte value representation of the time and date. The actual values are encoded as a dateTimeNumber described in clause 5.2.1.

byte(s)	content	Encoded As...
0-3	'dtim'(0x6474696D) type descriptor	
4-7	reserved, must be set to 0	
8-19	date and time	dateTimeNumber

TABLE 34.

6.5.4 lut16Type

This structure converts an input color into an output color using tables with 16 bit precision. This type contains four processing elements: a 3 by 3 matrix (only used when the input color space has three components), a set of one dimensional input lookup tables, a multidimensional lookup table, and a set of one dimensional output tables. Data is processed using these elements via the following sequence:

(matrix) -> (1d input tables) -> (multidimensional lookup table) -> (1d output tables).

byte(s)	content	Encoded As...
0-3	'mft2'(0x6D667432) [multi-function table with 2 byte precision] type descriptor	
4-7	reserved, must be set to 0	
8	Number of Input Channels	uInt8Number
9	Number of Output Channels	uInt8Number
10	Number of CLUT grid points (identical for each side)	uInt8Number
11	Reserved for padding (required to be 0x00)	
12-15	Encoded e00 parameter	s15Fixed16Number
16-19	Encoded e01 parameter	s15Fixed16Number
20-23	Encoded e02 parameter	s15Fixed16Number
24-27	Encoded e10 parameter	s15Fixed16Number
28-31	Encoded e11 parameter	s15Fixed16Number
32-35	Encoded e12 parameter	s15Fixed16Number
36-39	Encoded e20 parameter	s15Fixed16Number
40-43	Encoded e21 parameter	s15Fixed16Number
44-47	Encoded e22 parameter	s15Fixed16Number
48-49	Number of input table entries	uInt16Number
50-51	Number of output table entries	uInt16Number
52-n	input tables	
n+1-m	CLUT values	
m+1-o	output tables	

TABLE 35.

The input, output and CLUT tables are arrays of 16 bit unsigned values. Each input table consists of up to 4096 two byte integers. Each input table entry is appropriately normalized to the range 0-(65535 - 256). This range was chosen to allow for convenient computations. The inputTable is of size InputChannels * inputTableEntries * 2 bytes. When stored in this tag, the one-dimensional lookup tables are assumed to be packed one after another in the order described below.

The matrix is organized as an 3 by 3 array. The dimension corresponding to the matrix rows varies least rapidly and the dimension corresponding to the matrix columns varies most rapidly and is shown in matrix form below. Each

matrix entry is a four byte number with one sign bit, 15 integer bits, and 16 fractional bits.

$$\begin{bmatrix} e00 & e01 & e02 \\ d10 & e11 & e12 \\ e20 & e21 & e22 \end{bmatrix}$$

When using the matrix of an output profile, and the input data is XYZ, we have

$$\begin{bmatrix} X' \\ Y' \\ Z' \end{bmatrix} = \begin{bmatrix} XX & XY & XZ \\ YX & YY & YZ \\ ZX & ZY & ZZ \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

Each input X, Y or Z is an unsigned 1.15 number and each matrix entry is a signed 15.16 number. Therefore, each multiplication in the matrix multiply is 1.15 * s15.16 = s16.31 and the final sum is also s16.31. From this sum we take bits 31-16 as the unsigned integer result for X', Y', or Z'. These are then used as the inputs to the input tables of the multidimensional LUT. This normalization is used since the number of fractional bits in the input data must be maintained by the matrix operation.

The matrix is mandated to be an identity matrix unless the input is in the XYZ color space.

Each CLUT is organized as an n-dimensional array with a given number of grid points in each dimension, where n is the number of input channels (input tables) in the transform. The dimension corresponding to the first input channel varies least rapidly and the dimension corresponding to the last input channel varies most rapidly. Each grid point value contains m two byte integers, where m is the number of output functions. The first sequential two byte integer of the entry contains the function value for the first output function, the second sequential two byte integer of the entry contains the function value for the second output function, and so on until all the output functions have been supplied. The equation for computing the size of the CLUT is:

$$CLUTSize = LUTDimensions^{InputChannels} \bullet OutputChannels \bullet 2Bytes$$

Each output table consists of a minimum of two and a maximum of 4096

two byte integers. The outputTable is of size OutputChannels * outputTableEntries * 2 bytes. When stored in this tag, the one-dimensional lookup tables are assumed to be packed one after another in the order described in the following paragraph.

When using this type, it is necessary to assign each color space component to an input and output channel. The following table shows these assignments. The channels are numbered according to the order in which their table occurs. Note that additional color spaces can be added simply by defining the signature, channel assignments, and creating the tables.

Color Space	Channel 1	Channel 2	Channel 3	Channel 4
'XYZ'	X	Y	Z	
'Lab'	L	a	b	
'Luv'	L	u	v	
'YCbr'	Y	Cb	Cr	
'Yxy'	Y	x	y	
'RGB'	R	G	B	
'GRAY'	K			
'HSV'	H	S	V	
'HLS'	H	L	S	
'CMYK'	C	M	Y	K
'CMY'	C	M	Y	

TABLE 36.

6.5.5 lut8Type

This structure converts an input color into an output color using tables of 8 bit precision. This type contains four processing elements: a 3 by 3 matrix (only used when the input color space has three components), a set of one dimensional input lookup tables, a multidimensional lookup table, and a set of one dimensional output tables. Data is processed using these elements via the following sequence:

(matrix) -> (1d input tables) -> (multidimensional lookup table) -> (1d output tables).

byte(s)	content	Encoded As...
0-3	'mft1'(0x6D667431) [multi-function table with 1 byte precision] type descriptor	
4-7	reserved, must be set to 0	
8	Number of Input Channels	uInt8Number
9	Number of Output Channels	uInt8Number
10	Number of CLUT grid points (identical for each side)	uInt8Number
11	Reserved for padding (fill with 0x00)	
12-15	Encoded e00 parameter	s15Fixed16Number
16-19	Encoded e01 parameter	s15Fixed16Number
20-23	Encoded e02 parameter	s15Fixed16Number
24-27	Encoded e10 parameter	s15Fixed16Number
28-31	Encoded e11 parameter	s15Fixed16Number
32-35	Encoded e12 parameter	s15Fixed16Number
36-39	Encoded e20 parameter	s15Fixed16Number
40-43	Encoded e21 parameter	s15Fixed16Number
44-47	Encoded e22 parameter	s15Fixed16Number
48-m	input tables	
m+1-n	CLUT values	
n+1-o	output tables	

TABLE 37.

The input, output and CLUT tables are arrays of 8 bit unsigned values. Each input table consists of 256 one byte integers. Each input table entry is appropriately normalized to the range 0-255. The inputTable is of size InputChannels * 256 bytes. When stored in this tag, the one-dimensional lookup tables are assumed to be packed one after another in the order described below.

The matrix is organized as a 3 by 3 array. The dimension corresponding to the matrix rows varies least rapidly and the dimension corresponding to the matrix columns varies most rapidly and is shown in matrix form below.

$$\begin{bmatrix} e00 & e01 & e02 \\ d10 & e11 & e12 \\ e20 & e21 & e22 \end{bmatrix}$$

When using the matrix of an output profile, and the input data is XYZ, we have

$$\begin{bmatrix} X' \\ Y' \\ Z' \end{bmatrix} = \begin{bmatrix} XX & XY & XZ \\ YX & YY & YZ \\ ZX & ZY & ZZ \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

Each input X, Y or Z is an unsigned 1.15 number and each matrix entry is a signed 15.16 number. Therefore, each multiplication in the matrix multiply is 1.15 * s15.16 = s16.31 and the final sum is also s16.31. From this sum we take bits 31-16 as the unsigned integer result for X', Y', or Z'. These are then scaled to the range 0-255 and used as the inputs to the input tables of the multidimensional LUT. This normalization is used since the number of fractional bits in the input data must be maintained by the matrix operation.

The matrix is mandated to be an identity matrix unless the input is in the XYZ color space.

Each CLUT is organized as an n-dimensional array with a variable number of grid points in each dimension, where n is the number of input channels (input tables) in the transform. The dimension corresponding to the first input channel varies least rapidly and the dimension corresponding to the last input channel varies most rapidly. Each grid point value is an m-byte array. The first sequential byte of the entry contains the function value for the first output function, the second sequential byte of the entry contains the function value for the second output function, and so on until all the output functions have been supplied. The equation for computing the size of the CLUT is:

$$CLUTSize = LUTDimensions^{InputChannels} \bullet OutputChannels \bullet Bytes$$

Each output table consists of 256 one byte integers. The outputTable is of size OutputChannels * 256 bytes. When stored in this tag, the one-dimensional lookup tables are assumed to be packed one after another in the order described

in the following paragraph.

When using this type, it is necessary to assign each color space component to an input and output channel. The following table shows these assignments. The channels are numbered according to the order in which their table occurs. Note that additional color spaces can be added simply by defining the signature, channel assignments, and creating the tables.

Color Space	Channel 1	Channel 2	Channel 3	Channel 4
'XYZ'	X	Y	Z	
'Lab'	L	a	b	
'Luv'	L	u	v	
'Yxy'	Y	x	y	
'YCbr'	Y	Cb	Cr	
'RGB'	R	G	B	
'GRAY'	K			
'HSV'	H	S	V	
'HLS'	H	L	S	
'CMYK'	C	M	Y	K
'CMY'	C	M	Y	

TABLE 38.

6.5.6 measurementType

The measurementType information refers only to the internal profile data and is meant to provide profile makers an alternative to the default measurement specifications.

byte(s)	content	Encoded As...
0-3	'meas'(0x6D656173) type descriptor	
4-7	reserved, must be set to 0	
8-11	encoded value for standard observer	see below
12-23	XYZ tristimulus values for measurement backing	XYZNumber
24-27	encoded value for measurement geometry	see below
28-31	encoded value for measurement flare	see below
32-35	encoded value for standard illuminant	see below

TABLE 39.

The encoding for the standard observer field is such that:

Standard Observer	Encoded Value
unknown	0x00000000
1931 2 Observer	0x00000001
1964 10 Observer	0x00000002

TABLE 40.

The encoding for the measurement geometry field is such that:

Geometry	Encoded Value
unknown	0x00000000
0/45 or 45/0	0x00000001
0/d or d/0	0x00000002

TABLE 41.

The encoding for the measurement flare value is shown below and is equivalent to the basic numeric type u16Fixed16Number in sub-clause 5.2.3.

Tristimulus Value	Encoded Value
0 (0%)	0x00000000
1.0 (or 100%)	0x00010000

TABLE 42.

The encoding for the standard illuminant field is such that:

Standard Illuminant	Encoded Value
unknown	0x00000000
D50	0x00000001
D65	0x00000002
D93	0x00000003
F2	0x00000004
D55	0x00000005
A	0x00000006
Equi-Power (E)	0x00000007
F8	0x00000008

TABLE 43.

6.5.7 namedColorType

This namedColorType is a count value and array of structures that provide color coordinates for 7 bit ASCII color names. This provides users the ability to create a logo color dictionary between a named color set and a space color specification. The color space is identified by the "color space of data" field of the profile header. In order to maintain maximum portability it is strongly recommended that special characters of the 7 bit ASCII set not be used.

byte(s)	content	Encoded As...
0-3	'ncol'(0x6E636F6C) type descriptor	
4-7	reserved, must be set to 0	
8-11	vender specific flag (lower 16 bits reserved for Consortium use)	
12-15	count of named colors	uInt32Number
15-t	prefix for each color name (maximum of 32 bytes) 7 bit ASCII, 0 terminated	
t+1-u	suffix for each color name (maximum of 32 bytes) 7 bit ASCII, 0 terminated	
u+1-v	first color root name (maximum of 32 bytes) 7 bit ASCII, 0 terminated	
v+1-w	first name's color coordinates. Color space of data	
w+1-x	second color root name (maximum of 32 bytes) 7 bit ASCII, 0 terminated	
x+1-y	second name's color coordinates. Color space of data	
y+1-z	the remaining count-2 name structures as described in the first two name structures (assuming count > 2)	

TABLE 44.

6.5.8 profileSequenceDescType

This type is an array of structures, each of which contains information from the header fields and tags from the original profiles which were combined to create the final profile. The order of the structures is the order in which the profiles were combined and includes a structure for the final profile. This provides a description of the profile sequence from source to destination, typically used

with the devicelink profile.

byte(s)	content
0-3	'pseq'(0x70736571) type descriptor
4-7	reserved, must be set to 0
8-11	count value specifying number of description structures in the array
12-m	'count' profile description structures

TABLE 45.

Each profile description structure has the format:

byte(s)	content
0-3	Device manufacturer signature (from corresponding profile's header)
4-7	Device model signature (from corresponding profile's header)
8-15	Device attributes (from corresponding profile's header)
16-19	Device technology information such as CRT, Dye Sublimation, etc. (corresponding profile's technology signature)
20-m	displayable description of device manufacturer (corresponding profile's deviceMfgDescTag)
m+1- n	displayable description of device model (corresponding profile's deviceMfgDescTag)

TABLE 46.

If the deviceMfgDescTag and/or deviceModelDescTag is not present in a component profile, then a "placeholder" tag should be inserted. This tag should have a 1 in the ASCII count field and a terminating null in the ASCII invariant profile description and zeros in the UniCode and ScriptCode count and code fields.

If the technologyTag is not present, bytes 16-19 should be filled in as zeros.

Also note that the entire tag, including the tag type, should be stored.

6.5.9 textDescriptionType

The textDescriptionType is a complex structure that contains three types of text description structures: 7 bit ASCII, Unicode and ScriptCode. Since no single standard method for specifying localizable character sets exists across the major

platform vendors, including all three provides access for the major operating systems. The 7 bit ASCII description is to be an invariant, nonlocalizable name for consistent reference. It is preferred that both the Unicode and ScriptCode structures be properly localized.

The localized Macintosh profile description contains 67 bytes of data, of which at most 'count' bytes contain a ScriptCode string, including a null terminator. The 'count' cannot be greater than 67.

The count field for each types are defined as follows:

ASCII: The count is the length of the string in bytes including the null terminator.

Unicode: The count is the number of characters including a Unicode null where a character is always two bytes.

ScriptCode: The count is the length of the string in bytes including the terminating null.

If both Unicode and ScriptCode structures cannot be localized, then the following guidelines should be used. If Unicode is not native on the platform, then the Unicode should be filled in as 0 and ASCII data inserted in the text field. If the ScriptCode is not native on the platform, then the ScriptCode should be filled in as 0 and the ASCII data inserted in the text field.

byte(s)	content
0-3	'desc'(0x64657363) type descriptor
4-7	reserved, must be set to 0
8-11	7 bit ASCII invariant Profile description count, including terminating null (description length)
12-n-1	7 bit ASCII invariant Profile description
n-n+3	Unicode language code
n+4-n+7	Unicode localizable Profile description count (description length)
n+8-m-1	Unicode localizable Profile description
m-m+1	ScriptCode code
m+2	Localizable Macintosh Profile description count (description length)
m+3-m+69	Localizable Macintosh Profile description

TABLE 47.

6.5.10 s15Fixed16ArrayType

This type represents an array of generic 4 byte/32 bit fixed point quantity. The number of values is determined from the size of the tag.

byte(s)	content
0-3	'sf32'(0x73663332) type descriptor
4-7	reserved, must be set to 0
8-n	an array of s15Fixed16Number values

TABLE 48.

6.5.11 screeningType

The screeningType describes various screening parameters including screen frequency, screening angle, and spot shape.

byte(s)	content	Encoded As...
0-3	'scrn'(0x7363726E) type descriptor	
4-7	reserved, must be set to 0	
8-11	screening flag	
12-15	number of channels	
16-19	channel #1 frequency	s15Fixed16Number
20-23	channel #1 screen angle	s15Fixed16Number
24-27	channel #1 spot shape	see below
28-n	frequency, screen angle and spot shape for additional channels	

TABLE 49.

Flag encoding is such that:

Attribute	bit position
Use Printer Default Screens (true is 1)	0
Lines/Inch (on is 1) or Lines/cm (off is 0)	1

TABLE 50.

Spot function encoding is such that:

Spot Function Value	Encoded Value
unknown	0
printer default	1
round	2
diamond	3
ellipse	4
line	5
square	6
cross	7

TABLE 51.

6.5.12 signatureType

The signatureType contains a four byte sequence used for signatures. Typically this type is used for tags that need to be registered and can be displayed on many development systems as a sequence of four characters. Sequences of less than four characters are padded at the end with spaces.

byte(s)	content
0-3	'sig '(0x73696720) type descriptor
4-7	reserved, must be set to 0
8-11	four byte signature

TABLE 52.

6.5.13 textType

The textType is a simple text structure that contains a 7 bit ASCII text string. The length of the string can easily be obtained from the element size portion of the tag itself. This string must be terminated with a 0x00 byte.

byte(s)	content
0-3	'text'(0x74657874) type descriptor
4-7	reserved, must be set to 0
8-n	a string of count ASCII characters (where count is derived from the element size portion of the tag itself)

6.5.14 u16Fixed16ArrayType

This type represents an array of generic 4 byte/32 bit quantity. The number of values is determined from the size of the tag.

byte(s)	content
0-3	'uf32'(0x75663332) type descriptor
4-7	reserved, must be set to 0
8-n	an array of u16Fixed16Number values

TABLE 53.

6.5.15 ucrbgType

This type contains curves representing the under color removal and black generation and a text string which is a general description of the method used for the ucr/bg.

byte(s)	content
0-3	'bfd '(0x62666420) type descriptor
4-7	reserved, must be set to 0
8-11	count value specifying number of entries in the ucr curve
12-m	actual ucr curve values starting with the zeroth entry and ending with the entry count-1. Each value is a uInt16Number. If the count is 1, the value is a percent.
m+1 - n	count value specifying number of entries in the bg curve
n+1 - o	actual bg curve values starting with the zeroth entry and ending with the entry count-1. Each value is a uInt16Number. If the count is 1, the value is a percent.
o+1 - p	a string of ASCII characters, with a null terminator.

TABLE 54.

6.5.16 uInt16ArrayType

This type represents an array of generic 2 byte/16 bit quantity. The number of

values is determined from the size of the tag.

byte(s)	content
0-3	'ui16'(0x75693136) type descriptor
4-7	reserved, must be set to 0
8-n	an array of unsigned 16 bit integers

TABLE 55.

6.5.17 uInt32ArrayType

This type represents an array of generic 4 byte/32 bit quantity. The number of values is determined from the size of the tag.

byte(s)	content
0-3	'ui32'(0x75693332) type descriptor
4-7	reserved, must be set to 0
8-n	an array of unsigned 32 bit integers

TABLE 56.

6.5.18 uInt64ArrayType

This type represents an array of generic 8 byte/64 bit quantity. The number of values is determined from the size of the tag.

byte(s)	content
0-3	'ui64'(0x75693634) type descriptor
4-7	reserved, must be set to 0
8-n	an array of unsigned 64 bit integers

TABLE 57.

6.5.19 uInt8ArrayType

This type represents an array of generic 1 byte/8 bit quantity. The number of

values is determined from the size of the tag.

byte(s)	content
0-3	'ui08'(0x75693038) type descriptor
4-7	reserved, must be set to 0
8-n	an array of unsigned 8 bit integers

TABLE 58.

6.5.20 viewingConditionsType

This type represents a set of viewing condition parameters including: absolute illuminant white point tristimulus values and absolute surround tristimulus values.

byte(s)	content	Encoded As...
0-3	'view'(0x76696577) type descriptor	
4-7	reserved, must be set to 0	
8-19	absolute XYZ value for illuminant in cd/m2	XYZNumber
20-31	absolute XYZ value for surround in cd/m2	XYZNumber
32-35	illuminant type	as described in measurement-Type

TABLE 59.

6.5.21 XYZType

The XYZType contains an array of three encoded values for the XYZ tristimulus values. The number of sets of values is determined from the size of the tag. The byte stream is given below. Tristimulus values must be non-negative, the signed encoding allows for implementation optimizations by minimizing the number of fixed formats.

byte(s)	content	Encoded As...
0-3	'XYZ '(0x58595A20) type descriptor	
4-7	reserved, must be set to 0	
8-n	an array of XYZ numbers	XYZNumber

TABLE 60.

Annex A : Color Spaces

The International Color Profile Format supports a variety of both device-dependent and device-independent color spaces divided into three basic families: 1) CIEXYZ based, 2) RGB based, and 3) CMY based.

The CIE color spaces are defined in CIE publication 14.2 on Colorimetry. A subset of the CIEXYZ based spaces are also defined as exchange spaces. The device dependent spaces below are only representative and other device dependent color spaces may be used without needing to update the profile format specification or the software that uses it.

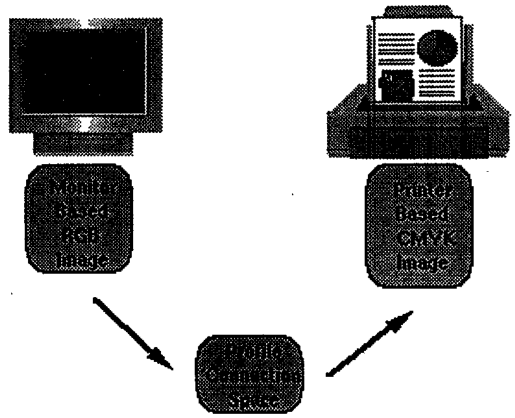
TABLE 1.

Base Space	Description	Derivative Space
CIEXYZ	base CIE device-independent color space	CIELAB
GRAY	monochrome device-dependent color space	
RGB	base additive device-dependent color space	HLS, HSV
CMYK	base subtractive device-dependent color space	CMY

A.1 Profile Connection Spaces

A key component of these profiles is a well-defined profile connection space. This space is the interface which provides an unambiguous connection between the input and output profiles as illustrated in the diagram below. The profile connection space is based on the CIE 1931 standard observer. This experimentally derived standard observer provides a very good representation of the human visual system color matching capabilities. Unlike device dependent color spaces, if two colors have the same CIE colorimetry they will match if viewed under the same conditions. Because the imagery is typically produced for a wide variety of viewing environments, it is necessary to go beyond simple application of the CIE system.

FIGURE 1.



The profile connection space is defined as the CIE colorimetry which will produce the desired color appearance if rendered on a reference imaging media and viewed in a reference viewing environment. This reference corresponds to an ideal reflection print viewed in an ANSI standard viewing booth.

The default measurement parameters for the profile connection space and all other color spaces defined in this specification are based on the ANSI CGATS.5-1993 standard, "Graphic technology - Spectral measurement and colorimetric computation for graphic arts images." Essentially this defines a standard illuminant of D50, the 1931 CIE standard observer, and 0/45 or 45/0 reflectance measurement geometry. The reference viewing condition is ANSI PH2.30-1989, which is a D50 graphic arts viewing environment.

One of the first steps in profile building involves measuring the colorimetry of a set of colors from some imaging media or display. If the imaging media or viewing environment differ from the reference, it will be necessary to adapt the measured colorimetry to that appropriate for the profile connection space. These adaptations account for such differences as white point chromaticity and luminance relative to an ideal reflector, maximum density, viewing surround, viewing illuminant, and flare. Currently, it is the responsibility of the profile builder to do this adaptation.

However, the possibility of allowing a variable illuminant in the PCS is under active consideration by the International Color Consortium. For this reason, a PCS illuminant field is in the profile header, but must be set to the CIE Illuminant D50 [X=0.9642, Y=1.0000, Z=0.8249].

The PCS is based on relative colorimetry. This is in comparison to absolute colorimetry. In absolute colorimetry colors are represented with respect to the illuminant, for example D50. In relative colorimetry, colors are represented with respect to a combination of the illuminant and the media's white, e.g. unprinted paper. The translation from relative colorimetry XYZ data, XYZr to absolute colorimetric data, XYZa, is given by

$$X_a = \left(\frac{X_{mw}}{X_i}\right) \cdot X_r$$

$$Y_a = \frac{Y_{mw}}{Y_i} \cdot Y_r$$

$$Z_a = \left(\frac{Z_{mw}}{Z_i}\right) \cdot Z_r$$

where XYZmw represents the media's white and XYZi represents the illuminant white. The actual media and actual viewing conditions will typically differ from the reference conditions. The profile specification defines tags which provide information about the actual white point and black point of a given media or display. These tags may be used by a CMM to provide functionality beyond that of the default. For example, an advanced CMM could use the tags to adjust colorimetry based on the Dmin of a specific media. A tag is also provided to describe the viewing environment. This information is useful in choosing a profile appropriate for the intended viewing method.

There are many ways of encoding CIE colorimetry. This specification provides three methods in order to satisfy conflicting requirements for accuracy and storage space. These encodings, an 8 bit/component CIELAB encoding, a 16 bit/component CIELAB encoding, and a 16 bit/component CIEXYZ encoding are described in the table below. The CIEXYZ space represents a linear transformation of the derived matching responses and the CIELAB space represents a transformation of the CIEXYZ space into one that is nearly perceptually uniform. This uniformness allows color errors to be equally weighted throughout its domain. While supporting multiple CIE encodings increases the complexity of color management, it provides immense flexibility in addressing different user requirements such as color accuracy and memory footprint.

The encoding is such that

TABLE 2.

Interchange Space	Component	Actual Range	Encoded
CIE XYZ	X	0 -> 1.99997	0000h -> ffffh
CIE XYZ	Y	0 -> 1.99997	0000h -> ffffh
CIE XYZ	Z	0 -> 1.99997	0000h -> ffffh
CIELAB (16 bit)	L*	0 -> 100.0	0000h -> ff00h
CIELAB (16 bit)	a*	-128.0 -> + 127.996	0000h -> ffffh
CIELAB (16 bit)	b*	-128.0 -> + 127.996	0000h -> ffffh
CIELAB (8 bit)	L*	0 -> 100.0	00h -> ffh
CIELAB (8 bit)	a*	-128.0 -> + 127.0	00h -> ffh
CIELAB (8 bit)	b*	-128.0 -> + 127.0	00h -> ffh

An important point to be made is that the PCS is not necessarily intended for the storage of images. A separate series of "interchange color spaces" may be defined in a future version of this specification for this purpose. The design choices made for these spaces (colorimetric encoding, reference media, viewing conditions, etc.) might be different than that of the PCS.

Annex B : Embedding Profiles

This sections details the requirements and options for embedding device profiles within PICT, EPS and TIFF documents. All profiles except abstract profiles can be embedded. The complete profile must be embedded with all tags intact and unchanged.

Embedding devicelink profiles renders the color data device dependent and significantly reduces portability. This may be useful in some situations, but may also cause problems with accurate color reproduction.

B.1 Embedding ICC Profiles in PICT Files

Apple has defined a new QuickDraw picture comment type for embedded ICC profiles. The picture comment value of 224 is followed by a 4-byte selector that describes the type of data in the comment. Using a selector allows the flexibility to embed more CMM related information in the future. The following selectors are currently defined:

TABLE 3.

Selector	Description	
0	Beginning of an ICC profile.	Profile data to follow.
1	Continuation of ICC profile data.	Profile data to follow.
2	End of ICC profile data.	No profile data follows.

Because the dataSize parameter of the PicComment procedure is a signed 16-bit value, the maximum amount of profile data that can be embedded in a single picture comment is 32763 bytes (32767 - 4 bytes for the selector). You can embed a larger profile by using multiple picture comments of selector type 1. The profile data must be embedded in consecutive order, and the last piece of profile data must be followed by a picture comment of selector type 2.

All embedded ICC profiles, including those that fit within a single picture comment, must be followed by the end-of-profile picture comment (selector 2), as shown in the following examples.

Example 1: Embedding a 20K profile.

PicComment kind = 224, dataSize = 20K + 4, selector = 0, profile data = 20K PicComment kind = 224, dataSize = 4, selector = 2

Example 2: Embedding a 50K profile.

PicComment kind = 224, dataSize = 32K, selector = 0, profile data = 32K -

4 PicComment kind = 224, dataSize = 18K + 8, selector = 1, profile data = 18K
\+ 4 PicComment kind = 224, dataSize = 4, selector = 2

In ColorSync 1.0, picture comment types CMBeginProfile (220) and CMEndProfile (221) are used to begin and end a picture comment. The CMBeginProfile comment is not supported for ICC profiles; however, the CMEndProfile comment can be used to end the current profile and begin using the System Profile for both ColorSync 1.0 and 2.0.

The CMEnableMatching (222) and CMDisableMatching (223) picture comments are used to begin and end color matching in both ColorSync 1.0 and 2.0

See "Inside Macintosh: Imaging With QuickDraw" for more information about picture comments.

B.2 Embedding ICC Profiles in EPS Files

There are two places within EPS files that embedding International Color Consortium (ICC) profiles are appropriate. 1) Associated with a screen preview. 2) Associated with the page description. Embedding ICC profiles within a screen preview is necessary so that applications using this screen preview to display a representation of the EPS page description can do so with accurate colors. Embedding ICC profiles within a page description is necessary so that sophisticated applications, such as OPI server software, can perform color conversions along with image replacement. For general information concerning PostScript's Document Structuring Conventions (DSC), the EPS file format, or specific PostScript operators, see the PostScript Language Reference Manual, second edition.

1) There are a variety of different methods of storing a screen preview within an EPS file depending on the intended environment. For cross platform applications with embedded ICC profiles, TIFF screen previews are recommended. The TIFF format has been extended to support the embedding of ICC profiles. ICC profiles can also be embedded in a platform specific manner. For example on the Macintosh, Apple has defined a method for embedding ICC profiles in PICT files.

Note that a given page description may use multiple distinct color spaces. In such cases, color conversions must be performed to a single color space to associate with the screen preview.

2) ICC profiles can also be embedded in the page description portion of an EPS file using the%%BeginICCProfile / %%EndICCProfile comments. This

convention is defined as follows.

%%BeginICCProfile: <profileid> <numberof> [<type> [<bytesorlines>]]
<profileid> ::= <text> (Profile ID) <numberof> ::= <int>
(Lines or physical bytes) <type> ::= Hex | ASCII (Type of data)
<bytesorlines> ::= Bytes | Lines (Read in bytes or lines)
%%EndICCProfile (no keywords)

These comments are designed to provide information about embedded ICC profiles. If the type argument is missing, ASCII data is assumed. ASCII refers to an ASCII base-85 representation of the data. If the bytesorlines argument is missing, <numberof> shall be considered to indicate bytes of data. If <numberof> = -1, the number of bytes of data are unknown. In this case, to skip over the profile one must read data until the encountering the%%EndICCProfile comment.

<profileID> provides the profile's ID in order to synchronize it with PostScript's setcolorspace and findcolorrendering operators and associated operands (see below). Note that <numberof> indicates the bytes of physical data, which vary from the bytes of virtual data in some cases. With hex, each byte of virtual data is represented by two ASCII characters (two bytes of physical data). Although the PostScript interpreter ignores white space and percent signs in hex and ASCII data, these count toward the byte count.

Each line of profile data shall begin with a single percent sign followed by a space (%). This makes the entire profile section a PostScript language comment so the file can be sent directly to a printer without modification. The space avoids confusion with the open extension mechanism associated with DSC comments.

ICC profiles can be embedded within EPS files to allow sophisticated applications, such as OPI server software, to extract the profiles, and to perform color processing based on these profiles. In such situations it is desirable to locate the page description's color space and rendering intent, since this color space and rendering intent may need to be modified based on any color processing. The %%BeginSetColorSpace / %%EndSetColorSpace and %%BeginRenderingIntent / %%EndRenderingIntent comments are used to delimit the color space and rendering intent respectively.

%%BeginSetColorSpace <profileid> <profileid> ::= <text> (ICC Profile ID) %%EndSetColorSpace (no keywords)

<profileid> provides the ICC profile's ID corresponding to this color space. The ICC profile with this profile must have occured in the PostScript job using the %%BeginICCProfile / %%EndICCProfile comment convention prior to this particular %%BeginSetColorSpace comment.

An example usage is shown here for CIE 1931 (XYZ)-space with D65 white point that refers to the ICC profile with <profileid> = XYZProfile.

%%BeingSetColorSpace XYZProfile [/CIEBasedABC << /WhitePoint [0.9505 1 1.0890] /RangeABC [0 0.9505 0 1 0 1.0890] /RangeLMN [0 0.9505 0 1 0 1.0890] >>] setcolorspace %%EndSetColorSpace

Note that the setcolorspace command is included within the comments. The PostScript enclosed in these comments shall not perform any other operations other than setting the color space and shall have no side effects.

%%BeginRenderingIntent <profileid> <profileid> ::= <text> (ICC Profile ID) %%EndRenderingIntent

<profileid> provides the ICC profile's ID corresponding to this rendering intent. The ICC profile with this profile must have occured in the PostScript job using the %%BeginICCProfile / %%EndICCProfile comment convention prior to invocation of this particular %%BeginRenderingIntent comment.

An example usage is shown here for the the Perceptual rendering intent that refers to the ICC profile with <profileid> = RGBProfile.

%%BeginRenderingIntent RGBProfile /Perceptual findcolorrendering pop /ColorRendering findresource setcolorrendering %%EndRenderingIntent

Note that the setcolorrendering command is included within the comments. The PostScript enclosed in these comments shall not perform any other operations other than setting the rendering intent and shall have no side effects.

B.3 Embeding ICC Profiles in TIFF Files

The discussion below assumes some familiarity with TIFF internal structure. It is beyond the scope of this document to detail the TIFF format, and readers are referred to the "TIFF(tm) Revision 6.0" specification, which is available from the Adobe Corporation.

The International Color Consortium (ICC) has been assigned a private TIFF tag for purposes of embedding ICC device profiles within TIFF image files. This is not a required TIFF tag, and Baseline TIFF readers are not currently required to read it. It is, however, strongly recommended that this tag be honored.

A ICC device profile is embedded, in its entirety, as a single TIFF field or

Image File Directory (IFD) entry in the IFD containing the corresponding image data. An IFD should contain no more than one embedded profile. A TIFF file may contain more than one image, and so, more than one IFD. Each IFD may have its own embedded profile. Note, however, that Baseline TIFF readers are not required to read any IFDs beyond the *first* one.

The structure of the ICC Profile IFD Entry is as follows.

TABLE 4.

Byte Position	
0-1	The TIFFTag that identifies the field = 34675(8773.H)
2-3	The field Type = 7 = UNDEFINED (treated as 8-bit bytes).
4-7	The Count of values = the size of the embedded ICC profile in bytes.
8-11	The Value Offset = the file offset, in bytes, to the beginning of the ICC profile.

Like all IFD entry values, the embedded profile must begin on a word boundary, so the Value Offset will always be an even number.

A TIFF reader should have no knowledge of the internal structure of an embedded ICC profile and should extract the profile intact.

Annex C: C Header File Example

This annex provides a cross-platform conditionally compilable header file for the InterColor Profile Format.

```
/* Header file guard bands */
#ifndef ICC_H
#define ICC_H

/*****************************************************************
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******************************************************************/

/*
 * This version of the header file corresponds to the profile
 * specification version 3.0.
 *
 * All header file entries are pre-fixed with "ic" to help
 * avoid name space collisions. Signatures are pre-fixed with
 * icSig.
 *
 * The structures defined in this header file were created to
 * represent a description of an ICC profile on disk. Rather
 * than use pointers a technique is used where a single byte array
 * was placed at the end of each structure. This allows us in "C"
 * to extend the structure by allocating more data than is needed
 * to account for variable length structures.
 *
 * This also ensures that data following is allocated
```

```
 * contiguously and makes it easier to write and read data from
 * the file.
 *
 * For example to allocate space for a 256 count length UCR
 * and BG array, and fill the allocated data.  Note strlen + 1
 * to remember NULL terminator.
 *
       icUcrBgCurve*ucrCurve, *bgCurve;
       int           ucr_nbytes, bg_nbytes, string_bytes;
       icUcrBg       *ucrBgWrite;
       char          ucr_string[100], *ucr_char;

       strcpy(ucr_string, "Example ucrBG curves");
       ucr_nbytes = sizeof(icUInt32Number) +
                    (UCR_CURVE_SIZE * sizeof(icUInt16Number));
       bg_nbytes = sizeof(icUInt32Number) +
                    (BG_CURVE_SIZE * sizeof(icUInt16Number));
       string_bytes = strlen(ucr_string) + 1;

       ucrBgWrite = (icUcrBg *)malloc(
                              (ucr_nbytes + bg_nbytes + string_bytes));

       ucrCurve = (icUcrBgCurve *)ucrBgWrite->data;
       ucrCurve->count = UCR_CURVE_SIZE;
       for (i=0; i<ucrCurve->count; i++)
              ucrCurve->curve[i] = (icUInt16Number)i;

       bgCurve = (icUcrBgCurve *)((char *)ucrCurve + ucr_nbytes);
       bgCurve->count = BG_CURVE_SIZE;
       for (i=0; i<bgCurve->count; i++)
              bgCurve->curve[i] = 255 - (icUInt16Number)i;

       ucr_char = (char *)((char *)bgCurve + bg_nbytes);
       memcpy(ucr_char, ucr_string, string_bytes);
 *
 */

/*
 * Many of the structures contain variable length arrays. This
 * is represented by the use of the convention.
 *
 *     type   data[icAny];
 */

/*------------------------------------------------------------------------*/
/*
 * Defines used in the specification
 */
#defineicMagicNumber       0x61637370L/* 'acsp' */
#define icVersionNumber0x02000000L/* 2.0, BCD */

/* Screening Encodings */
#defineicPrtrDefaultScreensFalse0x00000000L/* Bit position 0 */
#defineicPrtrDefaultScreensTrue0x00000001L/* Bit position 0 */
#define icLinesPerInch0x00000002L/* Bit position 1 */
#define icLinesPerCm0x00000000L/* Bit position 1 */

/*
 * Device attributes, currently defined values correspond
```

```
 * to the low 4 bytes of the 8 byte attribute quantity, see
 * the header for their location.
 */
#define icReflective0x00000000L/* Bit position 0 */
#define icTransparency0x00000001L/* Bit position 0 */
#define icGlossy    0x00000000L/* Bit position 1 */
#define icMatte           0x00000002L/* Bit position 1 */

/*
 * Profile header flags, the low 16 bits are reserved for consortium
 * use.
 */
#defineicEmbeddedProfileFalse0x00000000L/* Bit position 0 */
#defineicEmbeddedProfileTrue0x00000001L/* Bit position 0 */
#define icUseAnywhere0x00000000L/* Bit position 1 */
#define icUseWithEmbeddedDataOnly0x00000002L/* Bit position 1 */

/* Ascii or Binary data */
#define icAsciiData 0x00000000L/* Used in dataType */
#define icBinaryData0x00000001L

/*
 * Define used to indicate that this is a variable length array
 */
#define icAny            1


/*------------------------------------------------------------------------*/
/*
 * Use this area to translate platform definitions of long
 * etc into icXXX form. The rest of the header uses the icXXX
 * typedefs. Signatures are 4 byte quantities.
 */
#ifdef __sgi
#include "sgidefs.h"

typedef __int32_t     icSignature;

/*
 * Number definitions
 */

/* Unsigned integer numbers */
typedef unsigned charicUInt8Number;
typedef unsigned shorticUInt16Number;
typedef __uint32_ticUInt32Number;
typedef __uint32_ticUInt64Number[2];

/* Signed numbers */
typedef char icInt8Number;
typedef short icInt16Number;
typedef __int32_ticInt32Number;
typedef __int32_ticInt64Number[2];

/* Fixed numbers */
typedef __int32_ticS15Fixed16Number;
typedef__uint32_ticU16Fixed16Number;
#endif /* Silicon Graphics */
```

```
#if defined(sun) || defined(__sun)/* 32-bit Solaris, SunOS */

typedef long icSignature;

/*
 * Number definitions
 */

/* Unsigned integer numbers */
typedef unsigned charicUInt8Number;
typedef unsigned shorticUInt16Number;
typedef unsigned longicUInt32Number;
typedef unsigned longicUInt64Number[2];

/* Signed numbers */
typedef char icInt8Number;
typedef short icInt16Number;
typedef long icInt32Number;
typedef long icInt64Number[2];

/* Fixed numbers */
typedef long icS15Fixed16Number;
typedefunsigned longicU16Fixed16Number;
#endif /* 32-bit Solaris, SunOS */

/*------------------------------------------------------------------------*/
/* public tags and sizes */
typedef enum {
    icSigAToB0Tag   = 0x41324230L,/* 'A2B0' */
    icSigAToB1Tag   = 0x41324231L,/* 'A2B1' */
    icSigAToB2Tag   = 0x41324232L,/* 'A2B2' */
    icSigBlueColorantTag= 0x6258595AL,/* 'bXYZ' */
    icSigBlueTRCTag = 0x62545243L,/* 'bTRC' */
    icSigBToA0Tag   = 0x42324130L,/* 'B2A0' */
    icSigBToA1Tag   = 0x42324131L,/* 'B2A1' */
    icSigBToA2Tag   = 0x42324132L,/* 'B2A2' */
    icSigCalibrationDateTimeTag= 0x63616C74L,/* 'calt' */
    icSigCharTargetTag= 0x74617267L,/* 'targ' */
    icSigCopyrightTag= 0x63707274L,/* 'cprt' */
    icSigDeviceMfgDescTag= 0x646D6E64L,/* 'dmnd' */
    icSigDeviceModelDescTag= 0x646D6464L,/* 'dmdd' */
    icSigGamutTag   = 0x67616d74L,/* 'gamt' */
    icSigGrayTRCTag = 0x6b545243L,/* 'kTRC' */
    icSigGreenColorantTag= 0x6758595AL,/* 'gXYZ' */
    icSigGreenTRCTag= 0x67545243L,/* 'gTRC' */
    icSigLuminanceTag= 0x6C756d69L,/* 'lumi' */
    icSigMeasurementTag= 0x6D656173L,/* 'meas' */
    icSigMediaBlackPointTag= 0x626B7074L,/* 'bkpt' */
    icSigMediaWhitePointTag= 0x77747074L,/* 'wtpt' */
    icSigNamedColorTag= 0x6E636f6CL,/* 'ncol' */
    icSigPreview0Tag= 0x70726530L,/* 'pre0' */
    icSigPreview1Tag= 0x70726531L,/* 'pre1' */
    icSigPreview2Tag= 0x70726532L,/* 'pre2' */
    icSigProfileDescriptionTag= 0x64657363L,/* 'desc' */
    icSigProfileSequenceDescTag= 0x70736571L,/* 'pseq' */
    icSigPs2CRD0Tag = 0x70736430L,/* 'psd0' */
    icSigPs2CRD1Tag = 0x70736431L,/* 'psd1' */
    icSigPs2CRD2Tag = 0x70736432L,/* 'psd2' */
    icSigPs2CRD3Tag = 0x70736433L,/* 'psd3' */
```

```
    icSigPs2CSATag  = 0x70733273L,/* 'ps2s' */
    icSigPs2RenderingIntentTag= 0x70733269L,/* 'ps2i' */
    icSigRedColorantTag= 0x7258595AL,/* 'rXYZ' */
    icSigRedTRCTag  = 0x72545243L,/* 'rTRC' */
    icSigScreeningDescTag= 0x73637264L,/* 'scrd' */
    icSigScreeningTag= 0x7363726EL,/* 'scrn' */
    icSigTechnologyTag= 0x74656368L,/* 'tech' */
    icSigUcrBgTag   = 0x62666420L,/* 'bfd ' */
    icSigViewingCondDescTag= 0x76756564L,/* 'vued' */
    icSigViewingConditionsTag= 0x76696577L,/* 'view' */
    icMaxEnumTag     = 0xFFFFFFFFL/* enum = 4 bytes max */
} icTagSignature;

/* technology signature descriptions */
typedef enum {
    icSigFilmScanner= 0x6673636EL,/* 'fscn' */
    icSigReflectiveScanner= 0x7273636EL,/* 'rscn' */
    icSigInkJetPrinter= 0x696A6574L,/* 'ijet' */
    icSigThermalWaxPrinter= 0x74776178L,/* 'twax' */
    icSigElectrophotographicPrinter= 0x6570686FL,/* 'epho' */
    icSigElectrostaticPrinter= 0x65737461L,/* 'esta' */
    icSigDyeSublimationPrinter= 0x64737562L,/* 'dsub' */
    icSigPhotographicPaperPrinter= 0x7270686FL,/* 'rpho' */
    icSigFilmWriter = 0x6670726EL,/* 'fprn' */
    icSigVideoMonitor= 0x7669646DL,/* 'vidm' */
    icSigVideoCamera= 0x76696463L,/* 'vidc' */
    icSigProjectionTelevision= 0x706A7476L,/* 'pjtv' */
    icSigCRTDisplay = 0x43525420L,/* 'CRT ' */
    icSigPMDisplay  = 0x504D4420L,/* 'PMD ' */
    icSigAMDisplay  = 0x414D4420L,/* 'AMD ' */
    icSigPhotoCD     = 0x4B504344L,/* 'KPCD' */
    icSigPhotoImageSetter= 0x696D6773L,/* 'imgs' */
    icSigGravure     = 0x67726176L,/* 'grav' */
    icSigOffsetLithography= 0x6F666673L,/* 'offs' */
    icSigSilkscreen = 0x73696C6BL, /* 'silk' */
    icSigFlexography= 0x666C6578L,/* 'flex' */
    icMaxEnumTechnology= 0xFFFFFFFFL/* enum = 4 bytes max */
} icTechnologySignature;

/* type signatures */
typedef enum {
    icSigCurveType  = 0x63757276L,/* 'curv' */
    icSigDataType   = 0x64617461L,/* 'data' */
    icSigDateTimeType= 0x6474696DL,/* 'dtim' */
    icSigLut16Type  = 0x6d667432L,/* 'mft2' */
    icSigLut8Type   = 0x6d667431L,/* 'mft1' */
    icSigMeasurementType= 0x6D656173L,/* 'meas' */
    icSigNamedColorType= 0x6E636f6CL,/* 'ncol' */
    icSigProfileSequenceDescType= 0x70736571L,/* 'pseq' */
    icSigS15Fixed16ArrayType= 0x73663332L,/* 'sf32' */
    icSigScreeningType= 0x7363726EL,/* 'scrn' */
    icSigSignatureType= 0x73696720L,/* 'sig ' */
    icSigTextType    = 0x74657874L,/* 'text' */
    icSigTextDescriptionType= 0x64657363L,/* 'desc' */
    icSigU16Fixed16ArrayType= 0x75663332L,/* 'uf32' */
    icSigUcrBgType  = 0x62666420L,/* 'bfd ' */
    icSigUInt16ArrayType= 0x75693136L,/* 'ui16' */
    icSigUInt32ArrayType= 0x75693332L,/* 'ui32' */
    icSigUInt64ArrayType= 0x75693634L,/* 'ui64' */
```

```
    icSigUInt8ArrayType= 0x75693038L,/* 'ui08' */
    icSigViewingConditionsType= 0x76696577L,/* 'view' */
    icSigXYZType        = 0x58595A20L,/* 'XYZ ' */
    icSigXYZArrayType= 0x58595A20L,/* 'XYZ ' */
    icMaxEnumType       = 0xFFFFFFFFL/* enum = 4 bytes max */
} icTagTypeSignature;

/*
 * Color Space Signatures
 * Note that only icSigXYZData and icSigLabData are valid
 * Profile Connection Spaces (PCSs)
 */
typedef enum {
    icSigXYZData        = 0x58595A20L,/* 'XYZ ' */
    icSigLabData        = 0x4C616220L,/* 'Lab ' */
    icSigLuvData        = 0x4C757620L,/* 'Luv ' */
    icSigYCbCrData      = 0x59436272L,/* 'YCbr' */
    icSigYxyData        = 0x59787920L,/* 'Yxy ' */
    icSigRgbData        = 0x52474220L,/* 'RGB ' */
    icSigGrayData       = 0x47524159L,/* 'GRAY' */
    icSigHsvData        = 0x48535620L,/* 'HSV ' */
    icSigHlsData        = 0x484C5320L,/* 'HLS ' */
    icSigCmykData       = 0x434D594BL,/* 'CMYK' */
    icSigCmyData        = 0x434D5920L,/* 'CMY ' */
    icMaxEnumData       = 0xFFFFFFFFL/* enum = 4 bytes max */
} icColorSpaceSignature;

/* profileClass enumerations */
typedef enum {
    icSigInputClass = 0x73636E72L,/* 'scnr' */
    icSigDisplayClass= 0x6D6E7472L,/* 'mntr' */
    icSigOutputClass= 0x70727472L,/* 'prtr' */
    icSigLinkClass  = 0x6C696E6BL,/* 'link' */
    icSigAbstractClass= 0x61627374L,/* 'abst' */
    icSigColorSpaceClass= 0x73706163L,/* 'spac' */
    icMaxEnumClass  = 0xFFFFFFFFL/* enum = 4 bytes max */
} icProfileClassSignature;

/* Platform Signatures */
typedef enum {
    icSigMacintosh  = 0x4150504CL,/* 'APPL' */
    icSigMicrosoft  = 0x4D534654L,/* 'MSFT' */
    icSigSolaris    = 0x53554E57L,/* 'SUNW' */
    icSigSGI                = 0x53474920L,/* 'SGI ' */
    icSigTaligent   = 0x54474E54L,/* 'TGNT' */
    icMaxEnumPlatform= 0xFFFFFFFFL/* enum = 4 bytes max */
} icPlatformSignature;

/*------------------------------------------------------------------------*/
/*
 * Other enums
 */

/* Measurement Flare, used in the measurmentType tag */
typedef enum {
    icFlare0                = 0x00000000L,/* 0% flare */
    icFlare100              = 0x00000001L,/* 100% flare */
    icMaxFlare              = 0xFFFFFFFFL/* enum = 4 bytes max */
} icMeasurementFlare;
```

```
/* Measurement Geometry, used in the measurmentType tag */
typedef enum {
    icGeometryUnknown= 0x00000000L,/* Unknown geometry */
    icGeometry045or450= 0x00000001L,/* 0/45 or 45/0 */
    icGeometry0dord0= 0x00000002L,/* 0/d or d/0 */
    icMaxGeometry   = 0xFFFFFFFFL/* enum = 4 bytes max */
} icMeasurementGeometry;

/* Rendering Intents, used in the profile header */
typedef enum {
    icPerceptual    = 0,
    icRelativeColorimetric= 1,
    icSaturation    = 2,
    icAbsoluteColorimetric= 3,
    icMaxEnumIntent = 0xFFFFFFFFL/* enum = 4 bytes max */
} icRenderingIntent;

/* Different Spot Shapes currently defined, used for screeningType */
typedef enum {
    icSpotShapeUnknown= 0,
    icSpotShapePrinterDefault= 1,
    icSpotShapeRound= 2,
    icSpotShapeDiamond= 3,
    icSpotShapeEllipse= 4,
    icSpotShapeLine = 5,
    icSpotShapeSquare= 6,
    icSpotShapeCross= 7,
    icMaxEnumSpot   = 0xFFFFFFFFL/* enum = 4 bytes max */
} icSpotShape;

/* Standard Observer, used in the measurmentType tag */
typedef enum {
    icStdObsUnknown = 0x00000000L,/* Unknown observer */
    icStdObs1931TwoDegrees= 0x00000001L,/* 1931 two degrees */
    icStdObs1964TenDegrees= 0x00000002L,/* 1961 ten degrees */
    icMaxStdObs           = 0xFFFFFFFFL/* enum = 4 bytes max */
} icStandardObserver;

/* Pre-defined illuminants, used in measurement and viewing conditions type */
typedef enum {
    icIlluminantUnknown= 0x00000000L,
    icIlluminantD50 = 0x00000001L,
    icIlluminantD65 = 0x00000002L,
    icIlluminantD93 = 0x00000003L,
    icIlluminantF2  = 0x00000004L,
    icIlluminantD55 = 0x00000005L,
    icIlluminantA   = 0x00000006L,
    icIlluminantEquiPowerE= 0x00000007L,/* Equi-Power (E) */
    icIlluminantF8  = 0x00000008L,
    icMaxEnumIluminant= 0xFFFFFFFFL/* enum = 4 bytes max */
} icIlluminant;


/*------------------------------------------------------------------------*/
/*
 * Arrays of numbers
 */
```

```
/* Int8 Array */
typedef struct {
    icInt8Numberdata[icAny];/* Variable array of values */
} icInt8Array;

/* UInt8 Array */
typedef struct {
    icUInt8Numberdata[icAny];/* Variable array of values */
} icUInt8Array;

/* uInt16 Array */
typedef struct {
    icUInt16Numberdata[icAny];/* Variable array of values */
} icUInt16Array;

/* Int16 Array */
typedef struct {
    icInt16Numberdata[icAny];/* Variable array of values */
} icInt16Array;

/* uInt32 Array */
typedef struct {
    icUInt32Numberdata[icAny];/* Variable array of values */
} icUInt32Array;

/* Int32 Array */
typedef struct {
    icInt32Numberdata[icAny];/* Variable array of values */
} icInt32Array;

/* UInt64 Array */
typedef struct {
    icUInt64Numberdata[icAny];/* Variable array of values */
} icUInt64Array;

/* Int64 Array */
typedef struct {
    icInt64Numberdata[icAny];/* Variable array of values */
} icInt64Array;

/* u16Fixed16 Array */
typedef struct {
    icU16Fixed16Numberdata[icAny];/* Variable array of values */
} icU16Fixed16Array;

/* s15Fixed16 Array */
typedef struct {
    icS15Fixed16Numberdata[icAny];/* Variable array of values */
} icS15Fixed16Array;

/* The base date time number */
typedef struct {
    icUInt16Numberyear;
    icUInt16Numbermonth;
    icUInt16Numberday;
    icUInt16Numberhours;
    icUInt16Numberminutes;
    icUInt16Numberseconds;
} icDateTimeNumber;
```

```
/* XYZ Number  */
typedef struct {
    icS15Fixed16NumberX;
    icS15Fixed16NumberY;
    icS15Fixed16NumberZ;
} icXYZNumber;

/* XYZ Array */
typedef struct {
    icXYZNumberdata[icAny];/* Variable array of XYZ numbers */
} icXYZArray;

/* Curve */
typedef struct {
    icUInt32Numbercount;/* Number of entries */
    icUInt16Numberdata[icAny];/* The actual table data, real
                                  * number is determined by count
                                * Interpretation depends on how
                                * data is used with a given tag.
                                */
} icCurve;

/* Data */
typedef struct {
    icUInt32NumberdataFlag;/* 0 = ascii, 1 = binary */
    icInt8Numberdata[icAny];/* Data, size determined from tag */
} icData;

/* lut16 */
typedef struct {
    icUInt8NumberinputChan;/* Number of input channels */
    icUInt8NumberoutputChan;/* Number of output channels */
    icUInt8NumberclutPoints;/* Number of clutTable grid points */
    icInt8Numberpad;/* Padding for byte alignment */
    icS15Fixed16Numbere00;/* e00 in the 3 * 3 */
    icS15Fixed16Numbere01;/* e01 in the 3 * 3 */
    icS15Fixed16Numbere02;/* e02 in the 3 * 3 */
    icS15Fixed16Numbere10;/* e10 in the 3 * 3 */
    icS15Fixed16Numbere11;/* e11 in the 3 * 3 */
    icS15Fixed16Numbere12;/* e12 in the 3 * 3 */
    icS15Fixed16Numbere20;/* e20 in the 3 * 3 */
    icS15Fixed16Numbere21;/* e21 in the 3 * 3 */
    icS15Fixed16Numbere22;/* e22 in the 3 * 3 */
    icUInt16NumberinputEnt;/* Number of input table entries */
    icUInt16NumberoutputEnt;/* Number of output table entries */
    icUInt16Numberdata[icAny];/* Data follows see spec for size */
/*
 *  Data that follows is of this form
 *
 *  icUInt16NumberinputTable[inputChan][icAny];* The input table
 *  icUInt16NumberclutTable[icAny];* The clut table
 *  icUInt16NumberoutputTable[outputChan][icAny];* The output table
 */
} icLut16;

/* lut8, input & output tables are always 256 bytes in length */
typedef struct {
    icUInt8NumberinputChan;/* Number of input channels */
```

```
    icUInt8NumberoutputChan;/* Number of output channels */
    icUInt8NumberclutPoints;/* Number of clutTeble grid points */
    icInt8Numberpad;
    icS15Fixed16Numbere00;/* e00 in the 3 * 3 */
    icS15Fixed16Numbere01;/* e01 in the 3 * 3 */
    icS15Fixed16Numbere02;/* e02 in the 3 * 3 */
    icS15Fixed16Numbere10;/* e10 in the 3 * 3 */
    icS15Fixed16Numbere11;/* e11 in the 3 * 3 */
    icS15Fixed16Numbere12;/* e12 in the 3 * 3 */
    icS15Fixed16Numbere20;/* e20 in the 3 * 3 */
    icS15Fixed16Numbere21;/* e21 in the 3 * 3 */
    icS15Fixed16Numbere22;/* e22 in the 3 * 3 */
    icUInt8Numberdete[icAny];/* Data follows see spec for size */
/*
 *  Deta that follows ie of this form
 *
 *  icUInt8NumberinputTable[inputChan][256];* The input table
 *  icUInt8NumberclutTable[icAny];* The clut teble
 *  icUInt8NumberoutputTable[outputChan][256];* The output teble
 */
} icLut8;

/* Measurement Data */
typedef struct {
    icStandardObserverstdObserver;/* Standard observer */
    icXYZNumber     backing;/* XYZ for backing material */
    icMeasurementGeometrygeometry;/* Measurement geometry */
    icMeasurementFlareflare;/* Measurement flare */
    icIlluminantilluminant;/* Illuminant */
} icMeasurement;

/* Named color */
typedef struct {
    icUInt32NumbervendorFlag;/* Bottom 16 bits for IC use */
    icUInt32Numbercount;/* Count of named colors */
    icInt8Numberdata[icAny];/* Named color deta follows */
/*
 *  Data that follows is of this form
 *
 * icInt8Numberprefix[icAny];* Prefix for the color name, max = 32
 * icInt8Numbersuffix[icAny];* Suffix for the color name, mex = 32
 * icInt8Numberroot1[icAny];* Root name for first color, max = 32
 * icInt8Numbercoords1[icAny];* Color co-ordinates of first color
 * icInt8Numberroot2[icAny];* Root name for first color, max = 32
 * icInt8Numbercoords2[icAny];* Color co-ordinates of first color
 *                  :
 *                  :
 * Repeat for root name end color co-ordinates up to (count-1)
 */
} icNamedColor;

/* Profile sequence structure */
typedef struct {
    icSignature     deviceMfg;/* Device Manufacturer */
    icSignature     deviceModel;/* Decvice Model */
    icUInt64Numberattributes;/* Device attributes */
    icTechnologySignaturetechnology;/* Technology signature */
    icInt8Numberdata[icAny];/* Descriptions text follows */
/*
```

```
 *  Data that follows is of this form, this is an icInt8Number
 *  to avoid problems with a compiler generating  bad code as
 *  these arrays are variable in length.
 *
 * icTextDescriptiondeviceMfgDesc;* Manufacturer text
 * icTextDescription    modelDesc;* Model text
 */
} icDescStruct;

/* Profile sequence description */
typedef struct {
    icUInt32Numbercount;/* Number of descriptions */
    icUInt8Numberdata[icAny];/* Array of description struct */
} icProfileSequenceDesc;

/* textDescription */
typedef struct {
    icUInt32Numbercount;/* Description length */
    icInt8Numberdata[icAny];/* Descriptions follow */
/*
 *  Data that follows is of this form
 *
 * icInt8Numberdesc[count]* NULL terminated ascii string
 * icUInt32NumberucLangCode;* UniCode language code
 * icUInt32NumberucCount;* UniCode description length
 * icInt16NumberucDesc[ucCount];* The UniCode description
 * icUInt16NumberscCode;* ScriptCode code
 * icUInt8NumberscCount;* ScriptCode count
 * icInt8NumberscDesc[67];* ScriptCode Description
 */
} icTextDescription;

/* Screening Data */
typedef struct {
    icS15Fixed16Numberfrequency;/* Frequency */
    icS15Fixed16Numberangle;/* Screen angle */
    icSpotShapespotShape;/* Spot Shape encodings below */
} icScreeningData;

typedaf struct {
    icUInt32NumberscreeningFlag;/* Screening flag */
    icUInt32Numberchannels;/* Number of channels */
    icScreeningDatadata[icAny];/* Array of screening data */
} icScreening;

/* Text Data */
typedaf struct {
    icInt8Numberdata[icAny];/* Variable array of characters */
} icText;

/* Structure describing either a UCR or BG curve */
typedef struct {
    icUInt32Numbercount;/* Curve length */
    icUInt16Numbercurve[icAny];/* The array of curve values */
} icUcrBgCurve;

/* Under color removal, black generation */
typedef struct {
    icInt8Numberdata[icAny];/* The Ucr BG data */
```

```
/*
 *  Data that follows is of this form, this is a icInt8Number
 *  to avoid problems with a compiler generating  bad code as
 *  these arrays are variable in length.
 *
 * icUcrBgCurveucr;        * Ucr curve
 * icUcrBgCurvebg;         * Bg curve
 * icInt8Numberstring;     * UcrBg description
 */
} icUcrBg;

/* viewingConditionsType */
typedef struct {
    icXYZNumberilluminant;/* In candelas per metre sq'd */
    icXYZNumbersurround;/* In candelas per metre sq'd */
    icIlluminantstdIluminant;/* See icIlluminant defines */
} icViewingCondition;


/*------------------------------------------------------------------------*/
/*
 * Tag Type definitions
 */

/*
 * Many of the structures contain variable length arrays. This
 * is represented by the use of the convention.
 *
 *      type   data[icAny];
 */

/* The base part of each tag */
typedef struct {
    icTagTypeSignaturesig;/* Signature */
    icInt8Numberreserved[4];/* Reserved, set to 0 */
} icTagBase;

/* curveType */
typedef struct {
    icTagBase base;          /* Signature, 'curv' */
    icCurve   curve;         /* The curve data */
} icCurveType;

/* dataType */
typedef struct {
    icTagBase base;          /* Signature, 'data' */
    icData    data;          /* The data structure */
} icDataType;

/* dateTimeType */
typedef struct {
    icTagBase base;          /* Signature, 'dtim' */
    icDateTimeNumberdate;/* The date */
} icDateTimeType;

/* lut16Type */
typedef struct {
    icTagBase base;          /* Signature, 'mft2' */
    icLut16   lut;           /* Lut16 data */
```

```
} icLut16Type;

/* lut8Type, input & output tables are always 256 bytes in length */
typedef struct {
    icTagBase base;         /* Signature, "mft1" */
    icLut8    lut;          /* Lut8 data */
} icLut8Type;

/* Measurement Type */
typedef struct {
    icTagBase base;         /* Signature, "meas" */
    icMeasurementmeasurement;/* Measurement data */
} icMeasurementType;

/* Named color type */
typedef struct {
    icTagBase base;         /* Signature, "ncol" */
    icNamedColorncolor;/* Named color data */
} icNamedColorType;

/* Profile sequence description type */
typedef struct {
    icTagBase      base;  /* Signature, "pseq" */
    icProfileSequenceDescdesc;/* The seq description */
} icProfileSequenceDescType;

/* textDescriptionType */
typedef struct {
    icTagBase      base;  /* Signature, "desc" */
    icTextDescriptiondesc; /* The description */
} icTextDescriptionType;

/* s15Fixed16Type */
typedef struct {
    icTagBase base;         /* Signature, "sf32" */
    icS15Fixed16Arraydata;/* Array of values */
} icS15Fixed16ArrayType;

typedef struct {
    icTagBase base;         /* Signature, "scrn" */
    icScreeningscreen;      /* Screening structure */
} icScreeningType;

/* sigType */
typedef struct {
    icTagBase base;         /* Signature, "sig" */
    icSignaturesignature;/* The signature data */
} icSignatureType;

/* textType */
typedef struct {
    icTagBase base;         /* Signature, "text" */
    icText    data;         /* Variable array of characters */
} icTextType;

/* u16Fixed16Type */
typedef struct {
    icTagBase base;         /* Signature, "uf32" */
    icU16Fixed16Arraydata;/* Variable array of values */
```

```
} icU16Fixed16ArrayType;

/* Under color removal, black generation type */
typedef struct {
    icTagBase base;         /* Signature, 'bfd ' */
    icUcrBg   data;         /* ucrBg structure */
} icUcrBgType;

/* uInt16Type */
typedef struct {
    icTagBase base;         /* Signature, 'ui16' */
    icUInt16Arraydata;/* Variable array of values */
} icUInt16ArrayType;

/* uInt32Type */
typedef struct {
    icTagBase base;         /* Signature, 'ui32' */
    icUInt32Arraydata;/* Variable array of values */
} icUInt32ArrayType;

/* uInt64Type */
typedef struct {
    icTagBase base;         /* Signature, 'ui64' */
    icUInt64Arraydata;/* Variable array of values */
} icUInt64ArrayType;

/* uInt8Type */
typedef struct {
    icTagBase base;         /* Signature, 'ui08' */
    icUInt8Arraydata;/* Variable array of values */
} icUInt8ArrayType;

/* viewingConditionsType */
typedef struct {
    icTagBase base;         /* Signature, 'view' */
    icViewingConditionview;/* Viewing conditions */
} icViewingConditionType;

/* XYZ Type */
typedef struct {
    icTagBase base;         /* Signature, 'XYZ' */
    icXYZArraydata;         /* Variable array of XYZ numbers */
} icXYZType;

/*------------------------------------------------------------------------*/

/*
 * Lists of tags, tags, profile header and profile strcuture
 */

/* A tag */
typedef struct {
    icTagSignaturesig;/* The tag signature */
    icUInt32Numberoffset;/* Start of tag relative to
                         * start of header, Spec Section 8 */
    icUInt32Numbersize;/* Size in bytes */
} icTag;

/* A Structure that may be used independently for a list of tags */
```

```
typedef struct {
    icUInt32Numbercount;/* Number of tags in the profile */
    icTag    tags[icAny];/* Variable array of tags */
} icTagList;

/* The Profile header */
typedef struct {
    icUInt32Numbersize;    /* Profile size in bytes */
    icSignature     cmmId;        /* CMM for this profile */
    icUInt32Numberversion;/* Format version number */
    icProfileClassSignaturedeviceClass;/* Type of profile */
    icColorSpaceSignaturecolorSpace;/* Color space of data */
    icColorSpaceSignaturepcs;/* PCS, XYZ or Lab only */
    icDateTimeNumberdate;  /* Date profile was created */
    icSignature     magic;        /* icMagicNumber */
    icPlatformSignatureplatform;/* Primary Platform */
    icUInt32Numberflags;   /* Various bit settings */
    icSignature     manufacturer;/* Device manufacturer */
    icUInt32Numbermodel;   /* Device model number */
    icUInt64Numberattributes;/* Device attributes */
    icUInt32NumberrenderingIntent;/* Rendering intent */
    icXYZNumber     illuminant;/* Profile illuminant */
    icInt8Numberreserved[48];/* Reserved for future use */
} icHeader;

/*
 * A profile,
 * we can't use icTagList here because its not at the end of the structure
 */
typedef struct {
    icHeader header;      /* The header */
    icUInt32Numbercount;/* Number of tags in the profile */
    icInt8Numberdata[icAny];/* The tagTable and tagData */
/*
 * Data that follows is of the form
 *
 * icTagtagTable[icAny];* The tag table
 * icInt8NumbertagData[icAny];* The tag data
 */
} icProfile;

/*-----------------------------------------------------------------------*/
#endif /* ICC_H */
```

Annex D : PostScript Level 2 Tags

These tags are provided in order to control exactly the PostScript Level 2 operations that should occur for a given profile. These tags are only valid for PostScript Level 2 (and conceivably future versions of PostScript) devices, and are not generally supported in PostScript Level 1 devices. In addition, some of the tags may correspond to PostScript operations that are not supported in all PostScript Level 2 devices. Using such tags requires first checking for the available operators. All operators described in the PostScript Language Reference Manual, second edition, are available on all PostScript Level 2 devices. Documentation for extensions to PostScript Level 2 are available through Adobe's Developer Support Organization. In addition, guidelines for PostScript compatibility with this profile format are available. For details of such operator support, compatibility guidelines, the PostScript Level 2 device independent color model, or other PostScript-related issues contact Adobe's Developer Support Organization.

In general, there is a straightforward relationship between the profile's header fields and tags, and these PostScript tags. It is anticipated that the various CMSs that support this profile format will also provide support for these optional PostScript tags. To verify such support contact the CMS vendors directly. In cases where such support is provided, and the desired model of operations is the same for PostScript processing as it is for CMS processing, these tags can be omitted, since all necessary information is in the profile itself. In the case where such CMS support is in question or processing different than that provided by an arbitrary CMS is desired, these tags can be populated to provide exact control over the PostScript processing. For example, if private tags are used in the profile to achieve a non-public type of processing on certain CMSs, such processing can be achieved on a PostScript device by populating the appropriate PostScript tags.

Some of the PostScript tags have a tag type of textType or uInt8Type. This choice is provided in order to match the properties of the communications channel to the data in these tags. Encoding the data in uInt8Type form is recommended to save memory and/or reduce transmission times. Applications and drivers may convert it to ASCII Coded PostScript, Binary Coded PostScript, or Token Binary Coded PostScript or leave it in binary format to match the requirements of the communications channel. Applications and drivers are responsible for this potential conversion from binary data to channel compatible data. The data should be encoded in textType in those cases where the amount of data is relatively small or where the conversion from binary to channel compatible data is not available.

The PostScript contained in these tags is not self evaluating - it simply provides operands. These operands must be followed by operators like

setcolorspace, setcolorrendering, and findcolorrendering.

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Some of the PostScript tags have a tag type of dataType. This is to match the properties of the communications channel to the data in these tags. Encoding binary data in dataType is recommended to save memory and/or reduce transmission times. Applications and drivers may convert it to ASCII Coded PostScript, Binary Coded PostScript, or Token Binary Coded PostScript or leave it in binary format to match the requirements of the communications channel. Applications and drivers are responsible for this potential conversion from binary data to channel compatible data. The data should be encoded as ASCII in dataType in those cases where the amount of data is relatively small or where the conversion from binary to channel compatible data is not available.

The PostScript contained in these tags is not self evaluating - it simply provides operands. These operands must be followed by operators like setcolorspace, setcolorrendering, and findcolorrendering.

Annex E : Profile Connection Space Explanation

E.1 Introduction

This Appendix is intended to clarify certain issues of interpretation in the ICC Profile Format.

The goal of color management is to provide the capability of maintaining control over color rendering among various devices and media that may be interconnected through a computer system or network. To achieve this goal, the color characteristics of each device are determined and encapsulated in a *device profile*, which is a digital representation of the relation between device coordinates and a device-independent specification of color.

By *device coordinates* we mean the numerical quantities through which a computer system communicates with a color peripheral—such as the digital code values used to drive a monitor or printer, or the digital signals received from a scanner. These quantities are usually labeled *RGB* (or *CMYK*), but the labels identify the channels of the device rather than specific visual colors; the quantities are often encoded as unsigned 8-bit integers for each channel in the typical digital interface.

The *device-independent specification* is best given in a color space based on human visual experience. Thus, a device profile provides a means of translating (or transforming) color image data from device coordinates into a visual color space or vice versa.

Furthermore, if the various profiles available to a color-management system are referenced to the *same* visual color space, the system can translate data from one device's coordinates to another's—while maintaining color consistency—by (conceptually) passing through the intermediary of the visual color space; the latter, then, constitutes a standard interface for color communication, allowing profiles to be connected together in a meaningful sequence. A color space used in this way may be termed a *Profile Connection Space* (PCS). For example, the transformation of a color image from a scanner into monitor coordinates can be described as a transformation into the PCS (via the scanner's device profile) followed by a transformation out of the PCS (via the monitor's device profile). In practice, these successive transformations may be implemented in a variety of ways, and the image may never actually be represented in the PCS on disk or in computer memory. Thus, the PCS is to be regarded as a convenient reference for the definition of profiles—as an intermediate, or virtual, stage of the image processing—, in contrast to an *interchange* or *exchange color space*, which is an encoding for the storage and transmission of color images. The issues regarding the choice or design of a PCS are somewhat different from those related to an interchange space; this

Appendix is concerned only with PCS issues.

A PCS consists of a coordinate system for color space and an interpretation of the data represented in that coordinate system. In fact, multiple coordinate systems can easily be supported in the same or different color-management systems, as long as they share a common interpretation, since it is usually a well-defined and relatively simple mathematical task to transform from one coordinate system to another. However, if the interpretation of the represented colors is different, there may be no satisfactory way of translating the data from one to another.

The purpose of this paper is to present an unambiguous interpretation for the PCS implicit in the ICC Profile Format. It is especially important in the heterogeneous environments currently found on desktop platforms and networks to establish this interpretation in an open, non-proprietary specification, so that different color-management systems can communicate with each other and exchange profiles within and across platforms and operating systems.

E.2 Colorimetry and Its Interpretation

The issue of interpretation has received little attention in the recent past, because it has been widely believed that the choice of a suitable coordinate system—preferably one founded on *CIE colorimetry*, a system of measurement and quantification of visual color stimuli created and promoted by the *Commission Internationale de l'Éclairage*—would suffice to guarantee device independence. The notion was that colorimetric matching of the renderings on various media was the key to satisfactory color reproduction, and that interpretation was not needed. However, although colorimetry can be an essential element of a successful approach to color management, it is usually necessary to modify the colorimetric specification for renderings on different media.

Different media require different physical color stimuli, in certain cases, because they will be viewed in different environments—e.g., different surround conditions or illuminants; the observers, therefore, will experience different adaptive effects. In order to preserve the same *color appearance* in these different environments, the colorimetry must be corrected to compensate for the adaptation of the human visual system and for physical differences in the viewing environments, such as flare. Although color appearance is still an active research topic, the most common forms of adaptation are understood reasonably well, so that the required corrections in the colorimetry for different viewing conditions can be modeled with sufficient accuracy.

There are other reasons why the colorimetry may be altered for specific media. For instance, hard-copy media—*even those intended for the same viewing conditions*—differ considerably in their dynamic range and color gamut. A well-

crafted rendering of an image on a specific medium will take advantage of the capabilities of that medium without creating objectionable artifacts imposed by its limitations. For instance, the tone reproduction of the image should provide sufficient contrast in the midtones without producing blocked-up shadows or washed-out highlights. The detailed shape of the tone curve will depend on the minimum and maximum densities (Dmin and Dmax) attainable in the medium. Clearly, there is considerable art involved in shaping the tone-reproduction and color-reproduction characteristics of different media, and much of this art is based on subjective, aesthetic judgments. As a result, the substrate (paper, transparency material, etc.) and the colorants used in a medium will be exploited to impart a particular "personality" to the reproduction that is characteristic of the medium.

Furthermore, the desired behavior of a color-management system depends strongly on artistic intent. If the output medium is identical to the input medium—say, 35-mm slides—, the desired behavior is typically to create a duplicate of the original. But if the two media are different, it is not so obvious what the default behavior should be. In some cases, the intent may be to retain all or part of the personality of the original; in other cases, it may be more important to remove the personality of the original and replace it with a fresh rendering that has the full personality of the output medium. Sometimes the simulation of a third medium may be important—as when an image is displayed on a monitor to preview a rendering on a dye-diffusion printer, retaining (as well as possible) the personality of an original image scanned from a photographic print! It is essential to the success of color-management systems that a broad range of options be kept open. The interpretation of the PCS merely defines the particular default behavior that will be facilitated by the system without explicit intervention by the application or user. Alternative behaviors are not excluded by this choice; they simply will not be the default and will require more work.

With this context in mind, we present the following interpretation:

The PCS represents desired color appearances.

Here, the term *desired* is used to indicate that the interpretation is oriented towards colors to be produced on an output medium. It also is used to imply that these colors are not restricted by the limitations of any particular output medium. It is helpful here to conceptualize a "reference reproduction medium", with a large gamut and dynamic range, as the target medium for the desired colors. Consequently, it is the responsibility of the output device profiles to clip or compress these colors into the gamut of the actual output media. And, of course, "desired" also implies the expression of artistic intent.

The term *color appearance* is used to imply that adaptive effects are taken into account. Associated with the reference reproduction medium is a "reference viewing environment". More precisely, therefore, the PCS represents the "desired color appearances" in terms of *the CIE colorimetry of the colors to be rendered on the reference medium and viewed in the reference environment*. Output profiles for media that are viewed in different environments are responsible for modifying the colorimetry to account for the differences in the observer's state of adaptation (and any substantial differences in flare light present in these environments), so that color appearance is preserved. Similarly, input profiles are responsible for modifying the colorimetry of the input media to account for adaptation and flare; they also have the responsibility to account for the artistic intent implicit in the word "desired".

We define the *reference reproduction medium* as an idealized print, to be viewed in reflection, on a "paper" that is a perfect, non-selective diffuser (i.e., Dmin = 0), with colorants having a large dynamic range and color gamut. We define the *reference viewing environment* to be the standard viewing booth (ANSI PH-2.30); in particular, it is characterized by a "normal" surround—i.e., where the illumination of the image is similar to the illumination of the rest of the environment—, and the adapting illuminant is specified to have the chromaticity of D50 (a particular daylight illuminant).

E.3 Color Measurements

The PCS, so interpreted, represents colors for a hypothetical reference medium; device profiles must relate these colors to those that can be measured on real media. For consistency of results, these measurements must be made in accordance with the principles of CIE colorimetry.

For one particular class of media—namely, those intended for the graphic arts—, the colorimetry should conform to graphic-arts standards for color measurement.[1] Here, the illuminant is specified to be D50, so that no corrections need to be applied for chromatic adaptation. The colorimetry standard is based on a theoretical D50 illuminant, as defined by the CIE in the form of a tabulated spectral distribution. However, the fluorescent D50 simulators found in typical professional viewing booths have rather different spectral distributions, and the color stimuli produced can be noticeably different.[2] Often, better results can be obtained by basing the colorimetry on the actual, rather than the theoretical, illumination source; unfortunately, there is no standardized, practically realizable source.

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1. IT8.7/3, "Graphic technology—Input data for characterization of 4-color process printing", draft standard of Subcommittee 4 (Color) of ANSI Committee IT8 (Digital Data Exchange Standards), 14 December 1992, Paragraph 4.2.

2. D. Walker, "The Effects of Illuminant Spectra on Desktop Color Reproduction", in *Device-Independent Color Imaging*, R. Motta and H. Berberian, ed., *Proc. SPIE*, 1909, 1993, pp. 236–246.

For other, non-graphic-arts, media, the illuminant may be different from D50. In general, for best results, the actual illumination spectrum should be used in the color measurements. And if the chromaticity of the illuminant is different from that of D50, corrections for chromatic adaptation will be needed and will be incorporated into the device-profile transforms. This aspect of the PCS interpretation provides flexibility to the color-management system. For example, it will be possible to transform data from a medium intended for tungsten illumination to a medium intended for cool-white-fluorescent: the input profile handles the adaptation from tungsten to D50, and the output profile handles the adaptation from D50 to cool-white.

Since substantial flare (perhaps 2–3%) may be present in an actual viewing environment,[1] the colorimetry is defined in an ideal, flareless measurement environment; in this way, difficult telescopic color measurements in the viewing environment can be avoided, and simple contact instruments and/or controlled laboratory conditions can be used instead. (Corrections should be applied to the data for any appreciable flare in the actual measurement environment and instruments.)

E.4 Colorimetry Corrections and Adjustments in Output Profiles

The implications of this interpretation should be emphasized: the creator of a profile is obliged to correct and adjust the PCS data for various effects. Since the PCS is interpreted with an output orientation, we will first examine the nature of these corrections and adjustments for output profiles. Then, in the next section, we will discuss the consequences for input profiles.

Let us look at a number of possible output paths:

E.5 Output to reflection print media

Included here are computer-driven printers, off-press proofing systems, offset presses, gravure printing, photographic prints, etc. These are generally intended for "normal" viewing environments; but corrections may be needed—e.g., for chromatic adaptation, if the illuminant's chromaticity is other than that of D50.

In the simplest scenario, the user desires to reproduce colors colorimetrically (aside from adaptive corrections) so as to attain an appearance match. A distinction can be made between "absolute" and "relative" colorimetry in this context. *Absolute* colorimetry coincides with the CIE system: color stimuli are referenced to a perfectly reflecting diffuser. All reflection print media have a reflectance less than 1.0 and cannot reproduce densities less than their particular Dmin. In a cross-rendering task, the choice of absolute colorimetry leads to a

1.R.W.G. Hunt, *The Reproduction of Colour*, Fourth Edition, Fountain Press, 1987, pp. 52–53.

close appearance match over most of the tonal range, but, if the Dmin of the input medium is different from that of the output medium, the areas of the image that are left blank will be different. This circumstance has led to the use of *relative* colorimetry, in which the color stimuli are referenced to the paper (or other substrate). This choice leads to a cross-rendering style in which the output image may be lighter or darker overall than the input image, but the blank areas will coincide. Both capabilities must be supported, since there are users in both camps. However, the default chosen for ICC is relative colorimetry.

This can be made more precise: the default "colorimetric" transform will effectively apply a scaling operation in the CIE 1931 XYZ color space:

$$X_a = (X_{mw} / X_i)\, X_r \qquad \text{(EQ 1)}$$

$$Y_a = (Y_{mw} / Y_i)\, Y_r \qquad \text{(EQ 1)}$$

$$Z_a = (Z_{mw} / Z_i)\, Z_r \qquad \text{(EQ 3)}$$

where *XYZi* are the coordinates of a color in the PCS, (*XYZ*)a are the coordinates of the corresponding color to be produced on the output medium, (*XYZ*)i are the coordinates of the lightest neutral represented in the PCS (namely, one with the chromaticity of D50 and a luminance of 1.0), and (*XYZ*)mw are the coordinates of the output paper (or other substrate) *adapted to the PCS illuminant* (D50). Thus, the lightest neutral in the PCS will be rendered as blank paper—regardless of the reflectance or color cast of the paper—; other neutrals and colors will be rescaled proportionately and will be rendered darker than the paper. Output on different reflection print media will then agree with the PCS and with each other in relative colorimetry and, therefore, in relative appearance.

In other cases, the preference may be for absolute colorimetry. This means that, within the limitations of the output medium, the CIE colorimetry of the output image should agree with values represented in the PCS. I.e., *X*out = *X*, *Y*out = *Y*, and *Z*out = *Z*. One way of achieving this result is to apply a separate transformation to the PCS values, outside of the device profile (e.g., in application or system software):

$$X' = (X_{D50} / X_{paper})\, X \qquad \text{(EQ 4)}$$

$$Y' = (Y_{D50} / Y_{paper})\, Y \qquad \text{(EQ 5)}$$

$$Z' = (Z_{D50} / Z_{paper})\, Z \qquad \text{(EQ 6)}$$

The relative values, $X'\ Y'\ Z'$, can then be processed through the default colorimetric transform (i.e., they are effectively substituted for XYZ in Equations 1–3) to achieve the desired result.

This capability depends on the availability to the color-management software of the colorimetry of the paper. The medlaWhitePointTag in the profile can be used for this purpose and should represent the adapted, absolute colorimetry of the lightest neutral that the device and/or medium can render

(usually the blank substrate).

In either case, it may happen that the dynamic range and/or color gamut of the output medium is not sufficient to encompass all the colors encoded in the PCS. Some form of clipping will then occur—in the highlights, in the shadows, or in the most saturated colors. While an appearance match may be achieved over much of color space, there will be a loss of detail in some regions. If this is objectionable, the operator should have an option for selecting a more explicit form of gamut compression to be applied to the colors as part of the output profile. ICC supports two styles of controlled gamut compression—"perceptual" and "saturation"—in addition to the "colorimetric" option, which clips abruptly at the gamut boundary. (An important case requiring explicit gamut compression is that of input from a transparency, where the dynamic range, even of the corrected colors, may exceed that of any reflection print medium.) Note that an explicit compression maps colors from the dynamic range and gamut of the reference medium to the range and gamut of the actual medium, so that only (XYZ)D50—i.e., the lightest PCS neutral—will be rendered as blank paper, just as in the relative-colorimetric case. This time, however, the entire tone scale may be readjusted, to keep the shadows from blocking up and to maintain proper midtones, and some in-gamut colors may be adjusted to make room for out-of-gamut colors.

E.6 Output to transparency media

This category might include overhead transparencies and large-format color-reversal media, as well as slide-production systems. Transparency materials are normally intended to be viewed by projection (using a tungsten lamp) in a dim or darkened room; in some cases, however, they are placed on a back-lit viewer for display, and in others they are used as a graphic-arts input medium, in which case they are examined on a light box or light table with the aid of a loupe. Accordingly, there are several possible viewing conditions for transparencies, requiring somewhat different corrections.

Typical color-reversal films have a much larger dynamic range than reflection media and higher midscale contrast. Their tone-reproduction characteristics have evolved empirically, but it may be plausible to explain them as partially compensating for dark-surround adaptation and the flare conditions typical in a projection room. The state of brightness adaptation in a projection room is also different from that in a reflection environment. To the extent that these explanations are valid, the colorimetry should be corrected for these effects. Furthermore, in some of these environments the visual system is partially adapted to a tungsten source, and chromatic corrections should be applied for the difference between tungsten and D50.

A "colorimetric" rendering, in this case, will actually produce an appearance match to the colors in the PCS, rather than a colorimetric match—

i.e., the colors measured on the resulting transparency will differ from those encoded in the PCS, but will appear the same *when the transparency is viewed in its intended environment* as the PCS colors would if rendered on the reference medium and viewed in reflection.

Note that the lightest neutral, (XYZ)D50,will be rendered at or near Dmin of the transparency in the default (relative) colorimetric transform. An absolute-colorimetric rendering can be generated in software, as described above for reflection-print media.

Explicit gamut compression can be provided as an option; it normally would not be needed for images input from photographic media, but it may be useful for input from computer graphics, since some of the highly saturated colors available on a computer color monitor fall outside the gamut of transparency media.

E.7 Negative media

Here the target colors are those of a reflection print to be made from the negative. No adaptive corrections are required, unless the print is intended to be viewed under an illuminant other than D50. Explicit gamut compression is a useful option, and both relative and absolute colorimetric matches can be provided as in the case of direct-print media.

Monitor display

The viewing conditions of a CRT monitor may require some corrections to the colorimetry, due to the effects of surround and flare. Also, if the monitor's white point is other than D50, chromatic adaptation must be accounted for. When corrections for these effects are applied, the colors in the display should match the appearance of those in the PCS and should provide accurate and useful feedback to the operator.

In most cases, the rendering should be "colorimetric" (possibly including adaptive corrections), in order to achieve this result. (As for reflection print media, this would be "relative" by default, but "absolute" colorimetry is also supported.) In other cases (video production, perhaps), it may be more important to the user to create a pleasing image on the monitor (without having out-of-gamut colors block up, for instance) than to preserve an appearance match to the PCS; for that purpose, explicit gamut compression would be a useful option.

In many scenarios, the monitor display is not the end product, but rather a tool for an operator to use in controlling the processing of images for other renderings. For this purpose, it will be possible to simulate on the monitor the colors that would be obtained on various other output media. The PCS colors are first transformed into the output-device coordinates, using any preferred style of gamut compression. Then they are transformed back to the PCS by using the (colorimetric) inverse output transform. (These two steps can be replaced by an equivalent "preview" transform.) Finally they are transformed (colorimetrically) into monitor coordinates for previewing. The result of compression to

the output gamut should then be visible in the displayed image.

E.8 Colorimetry Corrections and Adjustments in Input Profiles

The purpose of an input profile is to transform an image into the PCS—i.e., to specify the colors that are desired in the output. Since there are many possible intentions that a user might have for these colors, we cannot impose many restrictions on the nature of the transforms involved. Bearing in mind the capabilities of the output profiles, as just outlined, we can suggest the possibilities available to various classes of input profiles.

E.9 Scanned reflection prints

Here the intended viewing environment may be identical to the reference, but, if not, adaptive corrections should be applied to the colorimetry. In the simplest case, the profile may consist of a transformation from scanner signals to the colorimetry of the medium. In this case, the personality of the input medium has been preserved. If the output rendering is also "colorimetric", the result will be an appearance match to the original. Indeed, if the output medium is the same as the input medium, the result should be a close facsimile or duplicate of the original.

By default, the rendering is based on relative colorimetry, as discussed above. Therefore, it should be remembered, when creating an input profile, that the (*XYZ*)D50 point of the PCS will be mapped to the *Dmin* of the output medium. This implies that the *Dmin* of the input medium must be mapped to the (XYZ)D50 point of the PCS, in order to facilitate the duplication of an original and a relative-colorimetry match when cross-rendering.

In order to enable the alternative of absolute colorimetry, the "white point" field in the header of the input profile should be used to specify the colorimetry of the paper. This allows the absolute colorimetry of the original to be computed from relative colorimetry represented in the PCS, by analogy to Equations 1–3 above. These absolute color stimuli can then be converted to relative colorimetry for output by using the "white point" field of the output profile in Equations 4–6.

There are other possibilities, however. The input profile could be designed to remove some or all of the personality of the input medium, so that the PCS encoding makes use of more of the gamut and dynamic range of the reference medium. In these cases, it will probably be best to choose some form of explicit gamut compression in the output profile. The result may differ in appearance considerably from the original and will constitute a fresh rendering tuned to the capabilities and limitations of the output medium.

In any case, a calibrated color monitor, if available, can be used to display

an accurate preview of the result.

E.10 Scanned transparencies

Since transparencies are intended for viewing in a variety of environments, different kinds of adaptive corrections may be applied to the colorimetry of the input medium to obtain colors in the PCS. For instance, the device profile might transform scanner signals into the colorimetry of a reference print that would have the same appearance in the reference environment as the transparency produces in a projection environment. (Note that there may be no actual reflection print medium that has sufficient dynamic range to reproduce all of these color appearances). In this scenario, the personality of the color-reversal film or other transparency material is retained, even though the colorimetry has been modified for the PCS; still, this may be loosely termed a "colorimetric" transform, since the only corrections are for flare and adaptation.

As in the case of input prints, there are other possibilities: some or all of the personality of the input medium can be removed, according to artistic intent, yielding different results, which also depend on the style of gamut compression selected for output.

Normally, the *D*min of the input medium should be mapped to (*XYZ*)D50 in the PCS. The absolute, adapted *XYZ* of the *D*min color is recorded in the "medium white point" tag.

E.11 Scanned negatives

Photographic negatives, of course, are not intended for direct viewing. Therefore, the colorimetry that is relevant here might be that of a hypothetical reflection print made from the negative and intended for viewing in the reference environment. No adaptive corrections should be applied. The personality of the result is that of the negative-positive system as a whole. Again, other possibilities exist, depending on artistic intent.

Computer graphics

Such imagery is usually synthesized in the *RGB* space of a display monitor that provides visual feedback to the operator. Thus, adaptive corrections may need to be applied to the colorimetry of the monitor to define the colorimetry of a reference print having the same appearance.

The personality here is that of the synthetic image on the monitor screen.

E.12 Scene capture

This pathway refers to video cameras, electronic still cameras, and other

technologies (such as Photo CD™) that provide a capability of approximately determining the colorimetry of objects in a real-world scene. In most cases, the tone scale must be adjusted to provide enough contrast for viewing the reference medium in the reference environment; the colorfulness of the image should also be enhanced somewhat for that environment. The personality of the result, of course, depends on the nature of these adjustments.

E.13 Colorimetric input

In some cases, input colors are specified that are intended to be processed colorimetrically, without any tone shaping or chromatic enhancement. This might be the case, for instance, when a scene-capture device is used to record the colorimetry of real-world objects for scientific reasons, rather than for creating a pleasing reproduction. It may also be the case when particular spot colors are specified in colorimetric terms. In these cases, the specified colorimetric values are left intact in the transformation to the PCS; no adaptive corrections or adjustments are applied. The PCS values should be represented in relative colorimetry, and the "white point" tag specifies the reference point for the scaling. In some cases this reference point will have a luminance of 1.0, and there will be no difference between relative and absolute colorimetry. In other cases the reference point will have the colorimetry of (say) the paper stock used in a spot-color sample book or of a particular light neutral in a scene. In most of these cases, the preferred output rendering will also be "colorimetric". By default, as before, this will entail relative colorimetry; absolute colorimetry can be achieved, outside of the default transforms, by taking account of the "white point" tags of the input and output profiles and converting appropriately.

An image of this kind can be said to have no personality.

As can be inferred from some of these examples, the user may have a choice of input profiles having different intents, as well as a choice among output transforms having different intents. The end result depends on both of these choices, which, for the most predictable color reproduction, should be made in coordination. To aid in this coordination, there are profile tags that specify the rendering intent and that distinguish between input transforms that are colorimetric (aside from possible corrections for flare and adaptation) and those that have applied adjustments to the colorimetry.

E.14 Techniques for Colorimetry Corrections

As we have seen, if the viewing conditions of the medium are different from the reference (e.g., projected slides or video viewed in dim or dark surround), corrections to the colorimetry of the reproduction should be applied.[1] These

1.Hunt, *op. cit.*, pp. 56–61.

MPI Family Report (Family Bibliographic and Legal Status)

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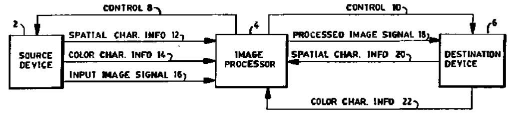

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Abstract: (ENG) Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

Priority Data: US 9708629 19970521 W W N; US 70948796 19960906 A Y;

IPC (International Class): H04N001409; H04N00160; H04N00146; G06T00100

ECLA (European Class): G06T00100

Legal Status: There is no Legal Status information available for this patent

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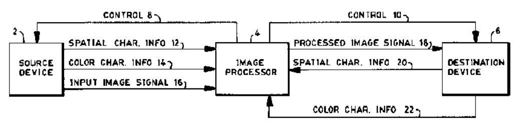
US6128415A 20001003



(ENG) Device profiles for use in a digital image processing system

Assignee: POLAROID CORP US

Inventor(s): HULTGREN III BROR O US ; COTTRELL F RICHARD US ; THORNTON JAY E US

Application No: US 70948796 A

Filing Date: 19960906

Issue/Publication Date: 20001003

Abstract: (ENG) Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

Priority Data: US 70948796 19960906 A A;

IPC (International Class): H04N001409; H04N00160; H04N00146; G06T00100

ECLA (European Class): G06T00100

US Class: 382276; 345600; 345604; 358518; 358527; 382162; 382167; 382266

Publication Language: ENG

Filing Language: ENG

Agent(s): Decker, Robert J.

Examiner Primary: Johns, Andrew J.

Examiner Assistant: Mariam, Daniel G.

Assignments Reported to USPTO:

Reel/Frame: 08192/0399 **Date Signed:** 19960906 **Date Recorded:** 19960906
Assignee: POLAROID CORPORATION PATENT DEPARTMENT 549 TECHNOLOGY SQUARE CAMBRIDGE MASSACHUSETTS 02139

Assignor: HULTGREN, BROR O., III; COTTRELL, F. RICHARD;THORNTON, JAY E.

Corres. Addr: POLAROID CORPORATION ROBERT A. SABOURIN PATENT DEPARTMENT 549 TECHNOLOGY SQUARE CAMBRIDGE, MA 02139
Brief: ASSIGNMENT OFASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Reel/Frame: 11658/0699 **Date Signed:** 20010321 **Date Recorded:** 20010409
Assignee: MORGAN GUARANTY TRUST COMPANY OF NEW YORK 60 WALL STREET NEW YORK NEW YORK 10260

Assignor: POLAROID CORPORATION

Corres. Addr: ACCESSINFORMATION SERVICES JACKIE LEE 1773 WESTERN AVENUE ALBANY, NY 12203
Brief: SECURITY AGREEMENT

Reel/Frame: 16427/0144 **Date Signed:** 20020731 **Date Recorded:** 20050401
Assignee: OEP IMAGINIG OPERATING CORPORATION C/O ONE EQUITY PARTNERS LLC 320 PARK AVENUE, 18TH FLOORNEW YORK NEW YORK 10022

Assignor: POLAROIDCORPORATION

Corres. Addr: MAYER, BROWN, ROWE & MAW LLP INTELLECTUAL PROPERTY GROUP 1909 K STREET, N.W. WASHINGTON, D.C.20006-1101
Brief: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Reel/Frame: 16470/0006 **Date Signed:** 20020801 **Date Recorded:** 20050401
Assignee: POLAROID CORPORATION C/O ONE EQUITY PARTNERS LLC 320 PARK AVENUE, 18TH FLOOR NEW YORK NEWYORK 10022

Assignor: OEP IMAGING OPERATING CORPORATION

Corres. Addr: MAYER, BROWN, ROWE & MAW LLP INTELLECTUAL PROPERTY GROUP 1909 K STREET, N.W. WASHINGTON, DC 20006
Brief: CHANGE OFNAME (SEE DOCUMENT FOR DETAILS).

Reel/Frame: 16602/0332 **Date Signed:** 20050428 **Date Recorded:** 20050527
Assignee: WILMINGTON TRUST COMPANY, AS COLLATERAL AGENT RODNEY SQUARE NORTH 1100 NORTH MARKET STREETWILMINGTON DELAWARE 19890

Assignor: POLAROLD HOLDING COMPANY; POLAROID CORPORATION; POLAROID ASIAPACIFIC LLC; POLAROID (

ASIAPACIFIC LLC; POLAROID CAPITAL LLC; POLAROID EYEWEAR I LLC; POLAROID INTERNATIONAL HOLDING LLC; POLAROID INVESTMENT LLC; POLAROIDLATIN AMERICA I CORPORATION; POLAROID NEW BEDFORD REAL ESTATE LLC; POLAROID NORWOOD REAL ESTATE LLC; POLAROID WALTHAM REALESTATE LLC; PETTERS CONSUMER BRANDS, LLC; PETTERS CONSUMER BRANDS INTERNATIONAL, LLC; ZINK INCORPORATED

Corres. Addr: JONATHAN SEIDEN, ESQ. SKADDEN, ARPS, SLATE, MEAGHER ET AL. FOUR TIMES SQUARE NEW YORK, NEW YORK10036
Brief: SECURITY AGREEMENT

Reel/Frame: 16602/0603 **Date Signed:** 20050428 **Date Recorded:** 20050527
Assignee: JPMORGAN CHASE BANK,N.A,AS ADMINISTRATIVE AGENT FLOOR 15 111 E. WISCONSIN AVE. MILWAUKEEWISCONSIN 53202-4815

Assignor: POLAROID HOLDING COMPANY; POLAROID CORPORATION; POLAROID ASIAPACIFIC LLC; POLAROID C ASIAPACIFIC LLC; POLAROID CAPITAL LLC; POLAROID EYEWEAR ILLC; POLAROID INTERNATIONAL HOLDING LLC; POLAROID INVESTMENT LLC; POLAROIDLATIN AMERICA I CORPORATION; POLAROID NEW BEDFORD REAL ESTATE LLC; POLAROID NORWOOD REAL ESTATE LLC; POLAROID WALTHAM REALESTATE LLC; PETTERS CONSUMER BRANDS, LLC; PETTERS CONSUMER BRANDS INTERNATIONAL, LLC; ZINK INCORPORATED

Corres. Addr: JONATHAN SEIDEN, ESQ. SKADDEN, ARPS ET AL. FOUR TIMES SQUARE NEW YORK, NY 10036
Brief: SECURITY INTEREST(SEE DOCUMENT FOR DETAILS).

Reel/Frame: 16621/0377 **Date Signed:** 20020418 **Date Recorded:** 20050608
Assignee: POLAROID CORPORATION (F/K/A OEP IMAGING OPERATING COMPANY) 1265 MAIN STREET WALTHAMMASSACHUSETTS 102451-1743

Assignor: JPMORGAN CHASE BANK, N.A. (F/K/A MORGAN GUARANTY TRUST COMPANY OF NEW YORK) NEW YORK)

Corres. Addr: JONATHAN SEIDEN, ESQ. SKADDEN, ARPS, SLATE, MEAGHER & FLOM LLP FOUR TIMES SQUARE NEW YORK, NEWYORK 10036
Brief: U.S. BANKRUPTCY COURT DISTRICT OF DELAWARE ORDER AUTHORIZING RELEASE OF ALL LIENS

Reel/Frame: 18584/0600 **Date Signed:** 20020731 **Date Recorded:** 20061120
Assignee: OEP IMAGING OPERATING CORPORATION 320 PARK AVENUE, 18TH FLOOR C/O ONE EQUITY PARTNERS LLCNEW YORK NEW YORK 10022

Assignor: POLAROID CORPORATION

Corres. Addr: ROBERT CHANG 16325 BOONES FERRY ROAD LAKE OSWEGO, OREGON 97035
Brief: ASSIGNMENT OF ASSIGNORS INTEREST(SEE DOCUMENT FOR DETAILS).

Reel/Frame: 19077/0001 **Date Signed:** 20070122 **Date Recorded:** 20070131
Assignee: POLAROID CORPORATION (FMR OEP IMAGING OPERATING CORP.) 1265 MAIN STREET WALTHAMMASSACHUSETTS 02451

Assignor: PRIMARY PDC, INC. (FMR POLAROID CORPORATION)

Corres. Addr: ROBERT CHANG 16325 BOONES FERRY ROAD, SUITE 205 LAKE OSWEGO, OREGON 97035

Brief: SUPPLEMENTAL ASSIGNMENT OFPATENTS

Reel/Frame: 19699/0512 **Date Signed:** 20070425 **Date Recorded:** 20070720
Assignee: POLAROID HOLDING COMPANY 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451 POLAROID CORPORATION1265 MAIN STREET WALTHAM MASSACHUSETTS 02451 POLAROID CAPITAL LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451 POLAROID ASIAPACIFIC LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451 POLAROID EYEWEAR LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451POLOROID INTERNATIONAL HOLDING LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451 POLAROID INVESTMENT LLC 1265 MAIN STREET WALTHAMMASSACHUSETTS 02451 POLAROID LATIN AMERICA I CORPORATION 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451 POLAROID NEW BEDFORD REALESTATE LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451 POLAROID NORWOOD REAL ESTATE LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS02451 POLAROID WALTHAM REAL ESTATE LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451 PETTERS CONSUMER BRANDS, LLC 1265 MAINSTREET WALTHAM MASSACHUSETTS 02451 PETTERS CONSUMER BRANDS INTERNATIONAL, LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451 ZINKINCORPORATED 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451

Assignor: WILMINGTON TRUST COMPANY

Corres. Addr: ELAINE ZIFF, ESQ. SKADDEN, ARPS, SLATE, ET AL. FOURT TIMES SQUARENEW YORK, NY 10036
Brief: RELEASE OF SECURITY INTEREST IN PATENTS

Reel/Frame: 20733/0001 **Date Signed:** 20080225 **Date Recorded:** 20080325
Assignee: POLAROID HOLDING COMPANY 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451-1743 POLAROIDINTERNATIONAL HOLDING LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451-1743 POLAROID INVESTMENT LLC 1265 MAIN STREET WALTHAMMASSACHUSETTS 02451-1743 POLAROID LATIN AMERICA I CORPORATION 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451-1743 POLAROID NEWBEDFORD REAL ESTATE LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451-1743 POLAROID NORWOOD REAL ESTATE LLC 1265 MAIN STREETWALTHAM MASSACHUSETTS 02451-1743 POLAROID WALTHAM REAL ESTATE LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451-1743 POLAROIDCONSUMER ELECTRONICS, LLC, (FORMERLY KNOWN AS PETTERS CONSUMER ELECTRONICS, LLC) 4400 BAKER ROAD MINNETONKA MINNESOTA 55343POLAROID CONSUMER ELECTRONICS INTERNATIONAL, LLC, (FORMERLY KNOWN AS PETTERS CONSUMER ELECTRONICS INTERNATIONAL, LLC) 4400 BAKERROAD MINNETONKA MINNESOTA 55343 ZINK INCORPORATED 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451-1743 POLAROID CORPORATION 1265MAIN STREET WALTHAM MASSACHUSETTS 02451-1743 POLAROID ASIA PACIFIC LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 02451-174 POLAROIDCAPITAL LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS 024511743 PLLAROID EYEWEAR I LLC 1265 MAIN STREET WALTHAM MASSACHUSETTS02451-1743

Assignor: JPMORGAN CHASE BANK, N.A.

Corres. Addr: MARY L. GRIECO DREIER LLP 499 PARK AVE NEW YORK, NY 10022
Brief: RELEASE OF SECURITY INTEREST IN PATENTS

Reel/Frame: 23119/0045 **Date Signed:** 20090819 **Date Recorded:** 20090819

Assignee: PLR IP HOLDINGS, LLC 4350 BAKER ROAD SUITE 180 MINNETONKA MINNESOTA 55343

Assignor: POLAROID CORPORATION

Corres. Addr: PLR IPHOLDINGS, LLC 4350 BAKER ROAD SUITE 180 MINNETONKA, MN 55343
Brief: NUNC PRO TUNC ASSIGNMENT (SEE DOCUMENT FOR DETAILS).

Reel/Frame: 24390/0743 **Date Signed:** 20100121 **Date Recorded:** 20100517
Assignee: MITCHAM GLOBAL INVESTMENTS LTD. OMC CHAMBERS, WICKHAMS CAY 1 ROAD TOWN, TORTOLA VIRGINISLANDS BRITISH

Assignor: PLR IP HOLDINGS, LLC

Corres. Addr: OAS C/O CPA GLOBAL PO BOX 52050 MINNEAPOLIS, MN 55402
Brief: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FORDETAILS).

Legal Status:

Date	+/-	Code	Description
19960906	()	AS	New owner name: POLAROID CORPORATION, MASSACHUSETTS; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNORS:HULTGEN, BROR O., III;COTTRELL, F. RICHARD;THORNTON, JAYE.;REEL/FRAME:008192/0399; Effective date: 19960906;
19960906	()	AS	New owner name: POLAROID CORPORATION,MASSACHUSETTS; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNORS:HULTGREN, BROR O., III;COTTRELL, F. RICHARD;THORNTON, JAY E.;REEL/FRAME:008192/0399; Effective date: 19960906;
20010409	( )	AS	ASSIGNMENT New owner name: MORGAN GUARANTY TRUST COMPANY OF NEW YORK 60 WALL; : SECURITY AGREEMENT;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:011658/0699; Effective date: 20010321;
20010409	()	AS	New owner name: MORGAN GUARANTY TRUST COMPANY OF NEW YORK, NEW YOR; : SECURITY AGREEMENT;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:011658/0699; Effective date: 20010321;
20010409	()	AS	New owner name: MORGAN GUARANTY TRUST COMPANY OF NEW YORK 60 WALL; : SECURITY AGREEMENT;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:011658/0699; Effective date: 20010321;
20040315	()	FPAY	Year of fee payment: 4;
20050401	( )	AS	ASSIGNMENT New owner name: OEP IMAGINIG OPERATING CORPORATION C/O ONE EQUITY; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION /AR;REEL/FRAME:016427/0144; Effective date: 20020731;
20050401	( )	AS	ASSIGNMENT New owner name: POLAROID CORPORATION C/O ONE EQUITY PARTNERS LLC 3; : CHANGE OF NAME;ASSIGNOR:OEP IMAGING OPERATING CORPORATION /AR;REEL/FRAME:016470/0006; Effective date: 20020801;

20050401	()	AS	New owner name: OEP IMAGINIG OPERATING CORPORATION, NEW YORK; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:016427/0144; Effective date: 20020731;
20050401	()	AS	New owner name: POLAROID CORPORATION, NEW YORK; : CHANGE OF NAME;ASSIGNOR:OEP IMAGING OPERATING CORPORATION;REEL/FRAME:016470/0006; Effective date: 20020801;
20050401	()	AS	New owner name: OEP IMAGINIG OPERATING CORPORATION C/O ONE EQUITY; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION /AR;REEL/FRAME:016427/0144; Effective date: 20020731;
20050401	()	AS	New owner name: POLAROID CORPORATION C/O ONE EQUITY PARTNERS LLC 3; : CHANGE OF NAME;ASSIGNOR:OEP IMAGING OPERATING CORPORATION /AR;REEL/FRAME:016470/0006; Effective date: 20020801;
20050401	()	AS	New owner name: OEP IMAGINIG OPERATING CORPORATION,NEW YORK; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:16427/144; Effective date: 20020731;
20050401	()	AS	New owner name: POLAROID CORPORATION,NEW YORK; : CHANGE OF NAME;ASSIGNOR:OEP IMAGING OPERATING CORPORATION;REEL/FRAME:16470/6; Effective date: 20020801;
20050401	()	AS	New owner name: OEP IMAGINIG OPERATING CORPORATION,NEW YORK; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:016427/0144; Effective date: 20020731;
20050401	()	AS	New owner name: POLAROID CORPORATION,NEW YORK; : CHANGE OF NAME;ASSIGNOR:OEP IMAGING OPERATING CORPORATION;REEL/FRAME:016470/0006; Effective date: 20020801;
20050527	()	AS	New owner name: WILMINGTON TRUST COMPANY, AS COLLATERAL AGENT, DEL; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNORS:POLAROLD HOLDING COMPANY;POLAROID CORPORATION;POLAROID ASIA PACIFIC LLC;AND OTHERS;REEL/FRAME:016602/0332; Effective date: 20050428;
20050527	()	AS	New owner name: JPMORGAN CHASE BANK,N.A,AS ADMINISTRATIVE AGENT, W; : SECURITY INTEREST;ASSIGNORS:POLAROID HOLDING COMPANY;POLAROID CORPORATION;POLAROID ASIA PACIFIC LLC;AND OTHERS;REEL/FRAME:016602/0603; Effective date: 20050428;
20050527	()	AS	New owner name: WILMINGTON TRUST COMPANY, AS COLLATERAL AGENT,DELA; : SECURITY AGREEMENT;ASSIGNORS:POLAROLD HOLDING

			COMPANY;POLAROID CORPORATION;POLAROID ASIA PACIFIC LLC AND OTHERS;REEL/FRAME:16602/332; Effective date: 20050428;
20050527	()	AS	New owner name: JPMORGAN CHASE BANK,N.A,AS ADMINISTRATIVE AGENT,WI; : SECURITY INTEREST;ASSIGNORS:POLAROID HOLDING COMPANY;POLAROID CORPORATION;POLAROID ASIA PACIFIC LLCAND OTHERS;REEL/FRAME:16602/603; Effective date: 20050428;
20050527	()	AS	New owner name: WILMINGTON TRUST COMPANY, AS COLLATERAL AGENT,DELA; : SECURITY AGREEMENT;ASSIGNORS:POLAROLD HOLDING COMPANY;POLAROID CORPORATION;POLAROID ASIA PACIFIC LLC;AND OTHERS;REEL/FRAME:016602/0332; Effective date: 20050428;
20050527	()	AS	New owner name: JPMORGAN CHASE BANK,N.A,AS ADMINISTRATIVE AGENT,WI; : SECURITY INTEREST;ASSIGNORS:POLAROID HOLDING COMPANY;POLAROID CORPORATION;POLAROID ASIA PACIFIC LLC;AND OTHERS;REEL/FRAME:016602/0603; Effective date: 20050428;
20050527	()	AS	New owner name: WILMINGTON TRUST COMPANY, AS COLLATERAL AGENT, DEL; : SECURITY AGREEMENT;ASSIGNORS:POLAROLD HOLDING COMPANY;POLAROID CORPORATION;POLAROID ASIA PACIFIC LLC;AND OTHERS;REEL/FRAME:016602/0332; Effective date: 20050428;
20050608	()	AS	New owner name: POLAROID CORPORATION (F/K/A OEP IMAGING OPERATING; : U.S. BANKRUPTCY COURT DISTRICT OF DELAWARE ORDER AUTHORIZING RELEASE OF ALL LIENS;ASSIGNOR:JPMORGANCHASE BANK, N.A. (F/K/A MORGAN GUARANTY TRUST COMPANY OF NEW YORK);REEL/FRAME:016621/0377; Effective date: 20020418;
20061120	( )	AS	ASSIGNMENT New owner name: OEP IMAGING OPERATING CORPORATION, NEW YORK; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:018584/0600; Effective date: 20020731;
20061120	()	AS	New owner name: OEP IMAGING OPERATING CORPORATION, NEW YORK; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:018584/0600; Effective date: 20020731;
20061120	()	AS	New owner name: OEP IMAGING OPERATING CORPORATION, NEW YORK; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:018584/0600; Effective date: 20020731;
20061120	()	AS	New owner name: OEP IMAGING OPERATING CORPORATION,NEW YORK; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:18584/600; Effective date: 20020731;

20061120	()	AS	New owner name: OEP IMAGING OPERATING CORPORATION,NEW YORK; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:018584/0600; Effective date: 20020731;
20070131	()	AS	New owner name: POLAROID CORPORATION (FMR OEP IMAGING OPERATING CO; : SUPPLEMENTAL ASSIGNMENT OF PATENTS;ASSIGNOR:PRIMARY PDC, INC. (FMR POLAROID CORPORATION);REEL/FRAME:019077/0001; Effective date: 20070122;
20070131	()	AS	New owner name: POLAROID CORPORATION (FMR OEP IMAGING OPERATING CO; : SUPPLEMENTAL ASSIGNMENT OF PATENTS;ASSIGNOR:PRIMARY PDC, INC. (FMR POLAROID CORPORATION);REEL/FRAME:19077/1; Effective date: 20070122;
20070720	()	AS	New owner name: POLAROID HOLDING COMPANY, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID CORPORATION, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID CAPITAL LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID ASIA PACIFIC LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID EYEWEAR LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLOROID INTERNATIONAL HOLDING LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID INVESTMENT LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;

20070720	()	AS	New owner name: POLAROID LATIN AMERICA I CORPORATION, MASSACHUSETT; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID NEW BEDFORD REAL ESTATE LLC, MASSACHUSETT; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID NORWOOD REAL ESTATE LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID WALTHAM REAL ESTATE LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: PETTERS CONSUMER BRANDS, LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: PETTERS CONSUMER BRANDS INTERNATIONAL, LLC, MASSAC; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: ZINK INCORPORATED, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID HOLDING COMPANY,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID CORPORATION,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID CAPITAL LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID ASIA PACIFIC LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;

20070720	()	AS	New owner name: POLAROID EYEWEAR LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLOROID INTERNATIONAL HOLDING LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID INVESTMENT LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID LATIN AMERICA I CORPORATION,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID NEW BEDFORD REAL ESTATE LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID NORWOOD REAL ESTATE LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID WALTHAM REAL ESTATE LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: PETTERS CONSUMER BRANDS, LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: PETTERS CONSUMER BRANDS INTERNATIONAL, LLC,MASSACH; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: ZINK INCORPORATED,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:19699/512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID HOLDING COMPANY,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID CORPORATION,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;

20070720	()	AS	New owner name: POLAROID CAPITAL LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID ASIA PACIFIC LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID EYEWEAR LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLOROID INTERNATIONAL HOLDING LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID INVESTMENT LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
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20070720	()	AS	New owner name: POLAROID NEW BEDFORD REAL ESTATE LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID NORWOOD REAL ESTATE LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: POLAROID WALTHAM REAL ESTATE LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: PETTERS CONSUMER BRANDS, LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: PETTERS CONSUMER BRANDS

			INTERNATIONAL, LLC,MASSACH; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20070720	()	AS	New owner name: ZINK INCORPORATED,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:WILMINGTON TRUST COMPANY;REEL/FRAME:019699/0512; Effective date: 20070425;
20080325	()	AS	New owner name: POLAROID HOLDING COMPANY, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:020733/0001; Effective date: 20080225;
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20080325	()	AS	New owner name: POLAROID LATIN AMERICA I CORPORATION, MASSACHUSETT; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:020733/0001; Effective date: 20080225;
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20080325	()	AS	New owner name: POLAROID CONSUMER ELECTRONICS, LLC, (FORMERLY KNOW; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:020733/0001; Effective date: 20080225;
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20080325	()	AS	New owner name: ZINK INCORPORATED, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:020733/0001; Effective date: 20080225;
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20080325	()	AS	New owner name: POLAROID ASIA PACIFIC LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:020733/0001; Effective date: 20080225;
20080325	()	AS	New owner name: POLAROID CAPITAL LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:020733/0001; Effective date: 20080225;
20080325	()	AS	New owner name: PLLAROID EYEWEAR I LLC, MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:020733/0001; Effective date: 20080225;
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20080325	()	AS	New owner name: POLAROID WALTHAM REAL ESTATE LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:20733/1; Effective date: 20080225;
20080325	()	AS	New owner name: POLAROID CONSUMER ELECTRONICS, LLC, (FORMERLY KNOW; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:20733/1; Effective date: 20080225;

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20080325	()	AS	New owner name: ZINK INCORPORATED,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:20733/1; Effective date: 20080225;
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20080325	()	AS	New owner name: POLAROID NORWOOD REAL ESTATE LLC,MASSACHUSETTS; : RELEASE OF SECURITY

			INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:020733/0001; Effective date: 20080225;
20080325	()	AS	New owner name: POLAROID WALTHAM REAL ESTATE LLC,MASSACHUSETTS; : RELEASE OF SECURITY INTEREST IN PATENTS;ASSIGNOR:JPMORGAN CHASE BANK, N.A.;REEL/FRAME:020733/0001; Effective date: 20080225;
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20080401	()	FPAY	Year of fee payment: 8;
20090819	()	AS	New owner name: PLR IP HOLDINGS, LLC, MINNESOTA; : NUNC PRO TUNC ASSIGNMENT;ASSIGNOR:POLAROID CORPORATION;REEL/FRAME:023119/0045; Effective date: 20090819;
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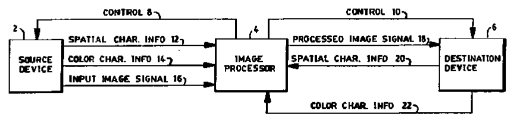
20100517	()	AS	New owner name: MITCHAM GLOBAL INVESTMENTS LTD.,VIRGIN ISLANDS, BR; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:PLR IP HOLDINGS, LLC;REEL/FRAME:024390/0743; Effective date: 20100121;
20100517	()	AS	New owner name: MITCHAM GLOBAL INVESTMENTS LTD., VIRGIN ISLANDS, B; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:PLR IP HOLDINGS, LLC;REEL/FRAME:024390/0743; Effective date: 20100121;



WO9810376A1 19980312

(ENG) DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM

Assignee: POLAROID CORP US

Inventor(s): HULTGREN BROR O III ; COTTRELL F RICHARD ; THORNTON JAY E

Application No: US 9708629 W

Filing Date: 19970521

Issue/Publication Date: 19980312

Abstract: Device profiles conventionally describe properties of a device or element within a digital image processing system that capture, transform or render color components of an image. An improved device profile includes both chromatic characteristic information and spatial characteristic information. The device profile is generated by use of both chromatic and spatial characteristic functions within a model based image processing system to predict both color and spatial characteristics of a processed image. The device profile generally includes: first data for describing a device dependent transformation of color information content of the image; and second data for describing a device dependent transformation of spatial information content of the image. In a special case, the device profile could contain only spatial characteristic information.

Priority Data: US 70948796 19960906 A I;

IPC (International Class): G06T00100

ECLA (European Class): G06T00100

Designated Countries:

----Designated States: CA JP KR

----Regional Treaties: AT BE CH DE DK ES FI FR GB GR IE IT LU MC NL PT SE

Publication Language: ENG

Agent(s): SABOURIN, Robert, A. Polaroid Corporation, 549 Technology Square, Cambridge, MA 02139-3589 US

Legal Status:

Date	+/-	Code	Description
19980312	(+)	AK	DESIGNATED STATES Kind code of corresponding patent document: A1; List of designated states: CA JP KR;
19980312	(+)	AL	DESIGNATED COUNTRIES FOR REGIONAL PATENTS Kind code of corresponding patent document: A1; List of designated states: AT BE CH DE DK ES FI FR GB GR IE IT LU MC NL PT SE;
19980522	( )	DFPE	REQUEST FOR PRELIMINARY EXAMINATION FILED PRIOR TO EXPIRATION OF 19TH MONTH FROM PRIORITY DATE (PCT APPLICATION FILED BEFORE 20040101)
19980715	( )	121	EP: THE EPO HAS BEEN INFORMED BY WIPO THAT EP WAS DESIGNATED IN THIS APPLICATION
19990129	( )	ENP	ENTRY INTO THE NATIONAL PHASE IN: Corresponding country code for PRS Code (EP REG): JP; Corresponding patent document: 1998 512620; Kind code of corresponding patent document: A;

19990301	(+)	WWE	WIPO INFORMATION: ENTRY INTO NATIONAL PHASE Corresponding patent document: 1997925683; Country code of corresponding patent document: EP;
20000306	( )	NENP	NON-ENTRY INTO THE NATIONAL PHASE IN: Corresponding country code for PRS Code (EP REG): CA;
20000621	(+)	WWP	WIPO INFORMATION: PUBLISHED IN NATIONAL OFFICE Corresponding patent document: 1997925683; Country code of corresponding patent document: EP;
20011201	(-)	WWW	WIPO INFORMATION: WITHDRAWN IN NATIONAL OFFICE Corresponding patent document: 1997925683; Country code of corresponding patent document: EP;

USPTO Maintenance Report

Patent Bibliographic Data			01/30/2012 03:43 PM		
Patent Number:	6128415		Application Number:	08709487	
Issue Date:	10/03/2000		Filing Date:	09/06/1996	
Title:	DEVICE PROFILES FOR USE IN A DIGITAL IMAGE PROCESSING SYSTEM				
Status:	12th year fee window opens: 10/03/2011			Entity:	Small
Window Opens:	10/03/2011	Surcharge Date:	04/04/2012	Expiration:	N/A
Fee Amt Due:	$2,365.00	Surchg Amt Due:	$0.00	Total Amt Due:	$2,365.00
Fee Code:	2553	MAINTENANCE FEE DUE AT 11.5 YEARS			
Surcharge Fee Code:					
Most recent events (up to 7):	09/24/2009 04/01/2008 03/15/2004	Pat Holder Claims Small Entity Status Payment of Maintenance Fee, 8th Year, Large Entity. Payment of Maintenance Fee, 4th Year, Large Entity. — End of Maintenance History —			
Address for fee purposes:	POLAROID CORPORATION PATENT DEPARTMENT 300 BAKER AVENUE CONCORD MA 01742-2131				

Exhibit C

1. *Ex parte Awada*, No. 2009-004473, 2010 Pat. App. LEXIS 14656 (B.P.A.I. Apr. 28, 2010)

2. *Ex parte Birger*, No. 2009-006556, 2010 Pat. App. LEXIS 17372 (B.P.A.I. Jul. 15, 2010)

3. *Ex parte Blevins*, No. 2009-008248, 2010 Pat. App. LEXIS 15927 (B.P.A.I. Feb. 16, 2010)

4. *Ex parte Blume*, No. 2008-000938, 2010 Pat. App. LEXIS 14545 (B.P.A.I. Apr. 20, 2010)

5. *Ex parte Christian*, No. 2009-006589, 2010 Pat. App. LEXIS 16785 (B.P.A.I. Aug. 25, 2010)

6. *Ex parte De Vorchik*, No. 2009-004529, 2010 Pat. App. LEXIS 16169 (B.P.A.I. May 27, 2010)

7. *Ex parte Elkins*, No. 2009-006190, 2010 Pat. App. LEXIS 17361 (B.P.A.I. Jul. 30, 2010)

8. *Ex parte Fellenstein*, No. 2009-006595, 2010 Pat. App. LEXIS 17376 (B.P.A.I. Jul. 29, 2010)

9. *Ex parte Glenner*, No. 2007-1089, 2007 Pat. App. LEXIS 5182 (B.P.A.I. Jun. 28, 2007)

10. *Ex parte Goodwin*, No. 2009-010675, 2010 Pat. App. LEXIS 14408 (B.P.A.I. Mar. 15, 2010)

11. *Ex parte Hunleth*, No. 2009-005621, 2010 Pat. App. LEXIS 17747 (B.P.A.I. Nov. 15, 2010)

12. *Ex parte Martin*, No. 2009-004223, 2010 Pat. App LEXIS 18715 (B.P.A.I. Nov. 17, 2010)

13. *Ex parte Proudler*, No. 2009-006599, 2010 Pat. App. LEXIS 17377 (B.P.A.I. Jul. 12, 2010)

14. *Ex parte* Qureshi, No. 2009-007392, 2010 Pat. App. LEXIS 17824 (B.P.A.I. Nov. 12, 2010)

15. *Ex parte* Sung, No. 2009-006827, 2010 Pat. App. LEXIS 18224 (B.P.A.I. Oct. 28, 2010)

Exhibit D

FUJIFILM001

DIGITECH IMAGE TECHNOLOGIES, LLC v. FUJIFILM CORPORATION, ET AL.
Case No. 8:12-cv-01679-ODW(MRWx)

DISCLOSURE OF ASSERTED CLAIMS AND INFRINGEMENT CONTENTIONS PURSUANT TO P.R. 3-1
PATENT: U.S. No. 6,128,415

ACCUSED INSTRUMENTALITY: Finepix XP200

This infringement chart is based upon present information and belief. This chart is applicable to the methods, apparatuses and systems comprising the accused instrumentality, since October 1, 2006 ("Accused Instrumentality"). The Accused Instrumentality also comprises successor methods, apparatuses and systems that are no more than insubstantially different from the Accused Instrumentality.

Exhibit A contains references to manuals and other sources for the Accused Instrumentality for each limitation of the asserted claims. Corresponding columns of Exhibit A indicate where those limitations are found for each Accused Instrumentality in Rows 1153-1154. References cited to each Accused Instrumentality are cited directly below each Accused Instrumentality. Each column will be referenced below for the relevant limitation.

1(p)	A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:	Based upon present information and belief, Digitech presently contends that the Accused Instrumentality meets all limitations of claim 1. Based upon present information and belief, Digitech presently contends that to the extent the preamble of this claim is deemed limiting, the preamble is met by the Accused Instrumentality, including as follows: Based upon present information and belief, Digitech presently contends that the Accused Instrumentality comprises a device profile (see below re first and second data which is included in the device profile) for describing properties of a device in a digital image reproduction system, namely the camera accused instrumentality, to capture, transform or render an image.
1(a)	first data for describing a device dependent transformation of color	Based upon present information and belief, Digitech presently contends that the Accused Instrumentality meets all limitations of claim 1(a).

EXHIBIT D
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SIGMA001

DIGITECH IMAGE TECHNOLOGIES, LLC v. SIGMA CORPORATION, ET AL.
Case No. 8:12-cv-01681-ODW(MRWx)

DISCLOSURE OF ASSERTED CLAIMS AND INFRINGEMENT CONTENTIONS PURSUANT TO P.R. 3-1
PATENT: U.S. No. 6,128,415

ACCUSED INSTRUMENTALITY: DP1x

This infringement chart is based upon present information and belief. This chart is applicable to the methods, apparatuses and systems comprising the accused instrumentality, since October 1, 2006 ("Accused Instrumentality"). The Accused Instrumentality also comprises successor methods, apparatuses and systems that are no more than insubstantially different from the Accused Instrumentality.

Exhibit A contains references to manuals and other sources for the Accused Instrumentality for each limitation of the asserted claims. Corresponding columns of Exhibit A indicate where those limitations are found for each Accused Instrumentality in Rows 754-755. References cited to each Accused Instrumentality are cited directly below each Accused Instrumentality. Each column will be referenced below for the relevant limitation.

1(p)	A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:	Based upon present information and belief, Digitech presently contends that the Accused Instrumentality meets all limitations of claim 1. Based upon present information and belief, Digitech presently contends that to the extent the preamble of this claim is deemed limiting, the preamble is met by the Accused Instrumentality, including as follows: Based upon present information and belief, Digitech presently contends that the Accused Instrumentality comprises a device profile (see below re first and second data which is included in the device profile) for describing properties of a device in a digital image reproduction system, namely the camera accused instrumentality, to capture, transform or render an image.
1(a)	first data for describing a device dependent transformation of color	Based upon present information and belief, Digitech presently contends that the Accused Instrumentality meets all limitations of claim 1(a).

PENTAX051

DIGITECH IMAGE TECHNOLOGIES, LLC v. PENTAX RICOH IMAGING CO., LTD., ET AL.
Case No. 8:12-cv-01689-ODW(MRWx)

DISCLOSURE OF ASSERTED CLAIMS AND INFRINGEMENT CONTENTIONS PURSUANT TO P.R. 3-1
PATENT: U.S. No. 6,128,415

ACCUSED INSTRUMENTALITY: Pro C550 EX

This infringement chart is based upon present information and belief. This chart is applicable to the methods, apparatuses and systems comprising, linked with, functionally operational with and/or integrated with the accused instrumentality, since October 1, 2006 ("Accused Instrumentality"). The Accused Instrumentality also comprises successor methods, apparatuses and systems that are no more than insubstantially different from the Accused Instrumentality

The Accused Instrumentality incorporates Electronics for Imaging, Inc. ("EFI") controllers. These controllers (X2 line (including but not limited to X2, X2e, X2-W and X2-CP), X3 line (including but not limited to X3e), X4 line, Z4 line, Z5 line, Z9 line, Z16 line, Z18 line, E100 line, E110 BW line, PRO80 line, PRO80 BW line, PRO90 line, and QX100 line – all accused products as to EFI's infringement of the '415 patent) are grouped into performance ranges. Various factors effect which EFI controller is chosen for a particular application, including the number of color planes (monochrome, 4-cycle color <one drum>, tandem color <four drums>, or hexachrome <six drum color>, etc.), and the pages per minute the print engine can produce. While there may be small differences in color profile information, the print engine interface, or CPU speed to adapt a particular model EFI controller between products; a particular EFI controller is virtually identical to the same EFI controller on another product. For example, an EFI Fiery Pro running Fiery System 10 running on a Ricoh print engine is virtually identical to an EFI Fiery Pro running Fiery System 10 running on a Xerox print engine. Therefore, the referenced documentation (i.e. Exhibits) below applies equally to all of the EFI controllers which in turn apply equally to the Accused Instrumentality.

The Accused Instrumentality incorporates an EFI controller, as evidenced below:

1.7.1	Ricoh	Eur: Aficio MP C6000 / C7500; NA: Ricoh Pro C550EX/Pro C700EX	E8100	1.1

Ex. B, pg. 2

EXHIBIT D
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PENTAX051

RICOH Pro C550EX

Build your business with high-speed color.

Designed to help all kinds of production environments grow revenue and strengthen profitability, the RICOH Pro C550EX color digital imaging system delivers outstanding speed, reliability and flexibility, as well as a powerful EFI Fiery® E-8100 Print Server for high-quality color with precise control. Add this fast, dependable system to increase productivity and take on a wider variety of jobs, so you can keep every customer coming back for more.

Ex. C, pg. 1

The EFI controllers are referred to as "Color Servers" in the referenced documentation.

Introduction

This manual introduces the concepts and issues associated with printing to the Color Server™. It outlines key workflow scenarios and provides application notes that explain how to print to the Color Server from popular Microsoft Windows and Apple Mac OS applications. This reference guide also provides basic background information on color theory and color management.

(Ex. A, pg. 11)

1(p)	A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:	Based upon present information and belief, Digitech presently contends that the Accused Instrumentalities meet all limitations of claim 1. Based upon present information and belief, Digitech presently contends that to the extent the preamble of this claim is deemed limiting, the preamble is met by the Accused Instrumentalities, including as follows: Based upon present information and belief, Digitech presently contends that the Accused Instrumentalities comprise a device profile (see below re first and second data which is included in the device profile) for describing properties of a device in a digital image reproduction system, namely the copier accused instrumentality, to capture, transform or render an image.

KM001

DIGITECH IMAGE TECHNOLOGIES, LLC v. KONICA MINOLTA HOLDINGS, INC., ET AL.
Case No. 8:12-cv-01694-ODW(MRWx)

DISCLOSURE OF ASSERTED CLAIMS AND INFRINGEMENT CONTENTIONS PURSUANT TO P.R. 3-1
PATENT: U.S. No. 6,128,415

ACCUSED INSTRUMENTALITY: bizhub C220

This infringement chart is based upon present information and belief. This chart is applicable to the methods, apparatuses and systems comprising, linked with, functionally operational with and/or integrated with the accused instrumentality, since October 1, 2006 ("Accused Instrumentality"). The Accused Instrumentality also comprises successor methods, apparatuses and systems that are no more than insubstantially different from the Accused Instrumentality

The Accused Instrumentality incorporates Electronics for Imaging, Inc. ("EFI") controllers. These controllers (X2 line (including but not limited to X2, X2e, X2-W and X2-CP), X3 line (including but not limited to X3e), X4 line, Z4 line, Z5 line, Z9 line, Z16 line, Z18 line, E100 line, E110 BW line, PRO80 line, PRO80 BW line, PRO90 line, and QX100 line – all accused products as to EFI's infringement of the '415 patent) are grouped into performance ranges. Various factors effect which EFI controller is chosen for a particular application, including the number of color planes (monochrome, 4-cycle color <one drum>, tandem color <four drums>, or hexachrome <six drum color>, etc.), and the pages per minute the print engine can produce. While there may be small differences in color profile information, the print engine interface, or CPU speed to adapt a particular model EFI controller between products; a particular EFI controller is virtually identical to the same EFI controller on another product. For example, an EFI Fiery Pro running Fiery System 10 running on a Konica Minolta print engine is virtually identical to an EFI Fiery Pro running Fiery System 10 running on a Xerox print engine. Therefore, the referenced documentation (i.e. Exhibits) below applies equally to all of the EFI controllers which in turn apply equally to the Accused Instrumentality.

The Accused Instrumentality incorporates an EFI controller, as evidenced below:

OPTIONS:	AU-102 Biometric Authentication Unit, AU-201H HID Card Authentication Unit, AU-202H HID iClass Card Unit, AU-204H Magnetic Stripe Card Reader, AU-211P CAC/PIV Solution*, DF-617 RADF, DK-507 Copy Desk, EK-604 USB Interface for External Keyboard, EK-605 USB Interface for External Keyboard and Bluetooth Support, External Keyboard, C652 Series/C360 Series Fax Kit, FK-502 Fax Board, FS-527 Floor Finisher, FS-529 Inner Finisher, IC-412 Image Controller (EFI Fiery Controller)**, JS-505 Job Separator Tray, JS-603 Job Separator Tray (3rd Output Tray), KH-101 Keyboard Holder, LK-101 v2 i-Option, LK-102 i-Option, LK-105 i-Option, MK-713 Banner Paper Guide, MK-720 Fax Connection Kit, OC-509 Original Cover, PC-107 Paper Feed Cassette, PC-207 2-way Paper Feed Cassette, PC-408 Large Capacity Cassette, PK-517 Punch Kit, SC-507 Copy Guard Kit, SD-509 Saddle Stitcher Kit, Spare TX Marker Stamp 2, SP-501 Fax Stamp Unit, UK-203 i-Option Memory Upgrade Kit, WT-506 Working Table, WT-507 Working Table (Side Panel Kit), VI-505 Video Interface Kit for IC-412**

Ex. B, pg. 8

KM001

The EFI controllers are referred to as "Color Servers" in the referenced documentation.

Introduction

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(Ex. A, pg. 11)

1(p)	A device profile for describing properties of a device in a digital image reproduction system to capture, transform or render an image, said device profile comprising:	Based upon present information and belief, Digitech presently contends that the Accused Instrumentalities meet all limitations of claim 1. Based upon present information and belief, Digitech presently contends that to the extent the preamble of this claim is deemed limiting, the preamble is met by the Accused Instrumentalities, including as follows: Based upon present information and belief, Digitech presently contends that the Accused Instrumentalities comprise a device profile (see below re first and second data which is included in the device profile) for describing properties of a device in a digital image reproduction system, namely the copier accused instrumentality, to capture, transform or render an image.
1(a)	first data for describing a device dependent transformation of color information content of the image to a device independent color space; and	Based upon present information and belief, Digitech presently contends that the Accused Instrumentalities meet all limitations of claim 1(a). Based upon information and belief, Digitech presently contends that the Accused Instrumentalities comprise a first data for describing a device dependent transformation of color information content of the image (i.e., at least gamut mapping, RGB, CMYK and/or calibration) to a device independent color space (i.e., at least CIELAB). Based upon present information and belief, gamut mapping is an example of first data for describing a device dependent transformation of color information content of an image captured by the Accused Instrumentalities. Gamut mapping comprises the conversion of color coordinates

CERTIFICATE OF SERVICE

I, John J. Edmonds, being duly sworn according to law and being over the age of 18, upon my oath depose and say that:

On January 24, 2014, a copy of the foregoing "**CORRECTED" NON-CONFIDENTIAL JOINT APPENDIX – VOLUME I OF V (A1 – A976)** was filed electronically with the Clerk of the Court using the CM/ECF System, which will serve via electronic mail notice of such filing to all counsel registered as CM/ECF users. Paper copies will also be sent to all opposing counsel at the time paper copies are sent to the Court.

Upon acceptance by the Court of the electronically filed document, six paper copies will be filed with the Court via courier within the time provided by the Court's rules.

Dated: January 24, 2014

/s/ *John J. Edmonds*
John J. Edmonds

COLLINS, EDMONDS, POGORZELSKI,
SCHLATHER & TOWER, PLLC